THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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(J. A. BERLY'S).

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THE NEWFOUNDLAND CABLE DISPUTE.

THE above has recently become quite a familiar heading in the daily Press, not only in this country, but also in the United States, and under it have been ventilated the grievances of the Commercial Cable Co. and the Anglo-American Telegraph Co. in respect to their respective rights under concessions obtained in this Colony. The dispute apparently was presented from the company's side only, until the Commercial Cable Co. openly charged the Government of Newfoundland with repudiating a "solemn contract," and this called forth a reply from Sir Edward Morris, the Premier of Newfoundland, now in London, denying the allegations, and charging the company with unfairly publishing "an *ex parte* statement of the case without having published side by side the reasons—well-known to the Commercial Cable Co.—why the Newfoundland Government halted before giving their assent."

A partial deadlock has, it appears, arisen between the company and the Government, the latter being unwilling to grant to the former a monopoly of cable traffic passing over the Newfoundland Government lines for a period of 25 years, on the ground that it is unfair, harmful to competition and to existing interests of another company. However, the company claim that the concession was given under the Seal of the Colony and the signature of the Governor, whereas Sir Edward maintains that the above condition could not be brought up for ratification before the Legislature without ample consideration, so that from this it would appear as if the concession had not yet gone through all its final stages before becoming absolute; hence we presume the cause of the dispute.

It is, of course, only natural that the Anglo-American Co. should oppose the granting of a concession with exclusive rights, such as above described, to their very active opponents the Commercial Cable Co., who have already secured a landing at Port-au-Basque for the cable to Canso, worked in conjunction with their system, for if granted it would exclude the company from any local benefit apart from that derived from their own lines.

It cannot be said that Sir Edward Morris is acting frivolously when he attempts to protect vested interests, and while the Atlantic companies enjoy practically equal conditions of working in Great Britain, it does not seem unreasonable to work upon this basis in Newfoundland, especially as judging by the statement printed in another column, the Anglo Company is quite prepared to work on a basis of fair competition. It cannot be unreasonable to permit persons or corporations to compete on an equal footing, and we hold that no injury should be inflicted on vested cable or other interests unless their owners give an indifferent, intermittent or bad service, maintain abnormal or high rates, or otherwise do not live up to the modern requirements and needs of the countries or places they connect. It is only right that under these last-named conditions concessionaires should give way, as it would not be proper for them to hamper the population in the race for a commercial existence by charging exorbitant rates or clinging to old-fashioned and out-of-date methods—and we

have yet to learn that the Anglo-American Telegraph Co. can be accused of this.

When this latter company obtained exclusive privileges in Newfoundland, landing rights, &c., were not looked upon as a valuable concession, as nations were anxious to obtain the facilities offered by rapid communication, but the days are changed, and such like monopolies are of the past, besides being absolutely contrary to the spirit of the Telegraph Convention to which Great Britain is an adherent.

The tendency of the present age is towards cheapness and the furnishing of as many routes as possible, and this has been proved not only by the laying of the Pacific Cable and the cables from Australia to Tasmania, but also by recent Conferences representative of responsible Home and Colonial opinion.

It will be recollected that the Report of the Inter-Departmental Committee on Cable Communications, 1902 (Cd. 1,056), dealt with the subject of landing rights, which the members of the Committee looked upon as important privileges, and there is no doubt that in the case under review the privilege means much to the Commercial Cable Co., who, by diverting the cables from Canso to Newfoundland, will, on their own showing, be enabled to work their cables at a calculated increase of speed of 35 per cent.

Of course, if on the final conclusion of a bargain it is found that more is given than is received, nothing should be said or done to upset it, and although it is regrettable that any misunderstanding should have occurred, the Newfoundland Government has given to the company the necessary land for landing the cables, which have been laid, landed, and opened for traffic, as evidenced by the posters exhibited by the company, and the main object sought in the concession and by expenditure has been attained. Our Colonies are agitating for an Imperial Atlantic cable and the acquisition, by the Government, of the Canadian land-lines, and in view of this possibility alone it would seem a pity to deprive the scheme of any support it might obtain from a British Colony.

Trial and Error.

To a very large extent, the old system of trial and error has been discredited for the development of inventions or the preparation of new designs, and although trials and tests are just as necessary at the present time as they have been in the past, experimental apparatus is now much more often satisfactory when first set to work.

There has been, perhaps, more excuse for the inability to foresee adverse effects in connection with electrical machinery than with any other class of apparatus, but few will deny that mistakes are often made which might have been avoided had the designer made a more careful study of the data at his disposal. As regards the purely electrical design of dynamos, motors, &c., so much experimental work has been made public that there would appear to be little excuse for failure to obtain the results desired with the first trial apparatus. The mechanical features, on the other hand, have not been dealt with to the same extent by scientific experiments, and many of the data available, having been originated at an earlier period, are not so easily looked up. For instance, bearings subjected to continuous downward pressure may often be found with oil grooves cut across their undersides, in the face of the experiments undertaken by a Research Committee of the Institution of Mechanical Engineers, which conclusively proved that oil will not enter through grooves in the pressure area. The power which can be transmitted by belting has been another stumbling block in the design of dynamos and motors, but the mistakes having mainly taken the form of unnecessarily large pulleys, the only effect has been to increase the cost. Here again ample data are available from exhaustive experiments with belts and pulleys, which were published many years before they could be wanted in this connection.

Many other instances of foreseeable errors will occur to everyone connected with the production of electrical apparatus. On the other hand, some recent inventions have been entirely worked out on paper, a single experiment having sufficed to prove their utility.

The designer or inventor of the future will need a sound scientific training, together with a full knowledge of previous experiments and developments in the line he intends to take up, the apparatus for working out such a man's ideas being far less costly than those required by an equally fertile inventor lacking the above qualifications.

Boiler Explosions.

It is often urged that our English construction work is too heavy. The *Locomotive*, the organ of the Great Hartford Boiler Insurance Co., of America, would not appear to be of this mind.

Taking 25 years of explosions in Great Britain, as given by the Board of Trade, which includes as explosions, occurrences of a most trivial order, including, we believe, once the melting of a fusible plug, the total of explosions is 1,705, of deaths thereby 697, and of injured persons 1,460. The annual average is 68·2 explosions, 27·9 deaths, and 58·4 injuries. In the United States, between January 1st, 1883, and December 31st, 1906, there were 7,408 explosions, which killed 7,144 persons and injured 10,874 others. Thus, in a year less there were four times the explosions and over tenfold the deaths. It is certain there is no such difference in the number of boilers.

Then the American explosions are of a worse order, for each explosion kills an average of over double as many as are killed by British explosions, or 0·96 as against 0·41. The British statistics include many steam pipe failures; the American include none of these unless on the boiler side of the stop valve.

The conclusion drawn is that boilers are made here with a larger factor of safety, and there are excellent reasons for believing this to be so. On the other hand, it must not be overlooked that many boilers in America must be off the beaten track, and exposed to less careful handling than is the case in older, more settled, and more populated countries. But, with every allowance made, the danger of American practice must be admitted. Indeed, to read the rules of the U.S. Board of Supervisors of Steam Vessels is enough to show that steam pressures are allowed that would not be considered safe here. An old copy shows that an American single-riveted boiler is allowed the usual pressure of a double-riveted boiler, and certain boilers were, upon this liberal allowance, allowed another 25 per cent. higher pressure.

German statistics for 31 years are also brought forward to show only one explosion for 17 American explosions, and one death for 27 American deaths. In all probability the number of German boilers over the period named—1877-1907—would be much fewer than in either Great Britain or America. The Hartford Co., in America, has consistently striven to mend the state of affairs. It considers that the Board of Trade inquiry—after an explosion—is a good moral influence. It brings the causes of an explosion before the public eye and carelessness of boiler owners is exposed. Though an inquiry will not prevent the explosion which has already occurred, it will undoubtedly lead to the exercise of greater care and bring owners into line.

Too many boiler owners even yet regard boiler insurance and inspection as a means of shifting responsibility, and very properly so, but owners find they cannot shift responsibility unless they have acted on suggestions and advice, and put things in good order. It is regretted that there is no such authority in the United States to exert the same moral effect as results from our Board of Trade inquiries. People are apt to scoff at the Board of Trade inquiry, and we have to confess to witnessing a good deal of apparently wasted time and many silly questions by examining counsel. But the Press is present, and the men concerned tell their story; thus there is publicity and evidence of good or bad material or workmanship, and this all tells upon boiler-makers, plate makers, inspectors, attendants and owners, and leads on to greater safety.

Every inquiry of importance spreads an influence through a given circle and acts as a spur in keeping men up to the top notch.

TWO USEFUL CABLE-LAYING APPLIANCES.

By C. A. SMITH, A.M.A.I.E.E.

When one is working in some remote part of the world, away from the large manufacturing centres where up-to-date appliances and tools can be obtained on short notice, he will,

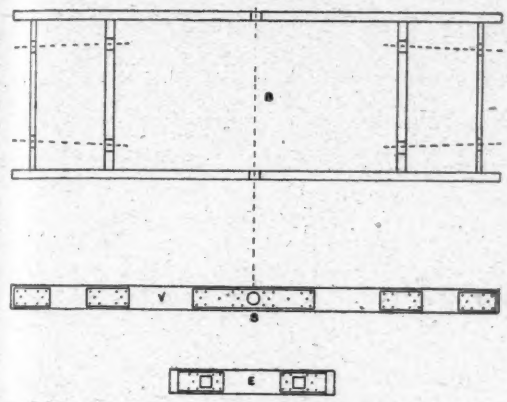


Fig. 1.

as likely as not, resort to inventing, and make the article required for a given purpose himself.

It was because the author had to design his own "cable drum carriage" and a special "duct reel" for threading underground cable tubes with draw wires that he thought, perhaps, some of the readers of the Review, who, being similarly placed, would like particulars of these home-made accessories, which, it is believed, while having some novel features, will prove to be of considerable service to the duct and cable-laying gangs.

The drum carriage is essentially a pair of stout wheels with a detachable steel spindle as usual, but, as will be seen

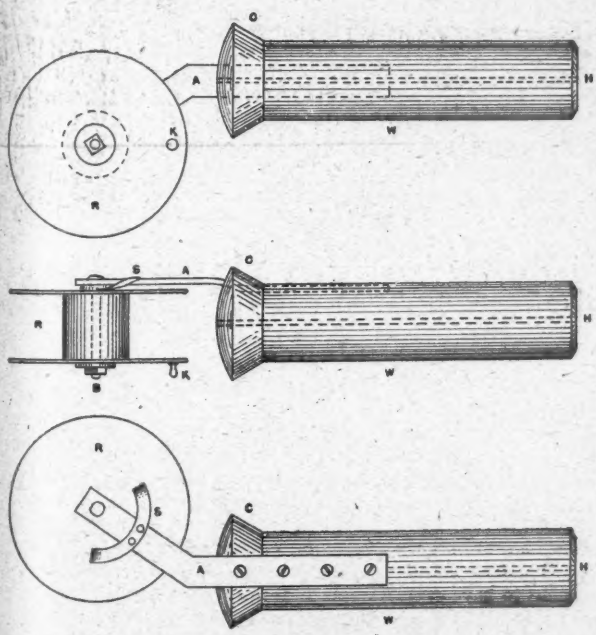


Fig. 2.

from the view, it has a special light frame body through which the spindle is threaded, and is provided with a pair of detachable shafts. It will be seen from the drawing, fig. 1, by the dotted lines, that the shafts can be attached to either end of the body, thus obviating the necessity of turning the vehicle round if required to be drawn in the opposite direction. This has proved to be of no small advantage in the writer's experience, when, for instance, the carriage is run into an alley or becomes stuck in a rut, and it cannot be turned round to get it out, in which case all that is necessary is to alter the position of the shafts—the work of a moment. No doubt objection will be taken to having to thread the spindle through so many holes in rigging up, but the writer's contention is, that as the carriage is usually loaded in the cable yard or stores where the cable gangs meet for instructions, the same hands employed on the job can quickly and easily put the thing together, and the objection becomes lost in view or the great convenience which the design offers when out on the work. As soon as the scene of the cable laying is reached, the shafts are detached by removing four pins, and the front or back end of the frame swung up out of the way as required. For those who wish to construct a drum carriage on this principle, the following measurements will be appreciated :—(See fig. 1, B V and E).

Diameter of wheels	2·30 metres
Length of body B	4·00 "
Width of body	1·35 "
Length of shafts	3·20 "
Length of spindle	2·65 "
Diameter of spindle...	7·5 centimetres
Diameter of holes in wheels	8·0 "
Diameter of central hole S...	8·5 "
Size of square shaft holes	9·5 "
Distance between two end stays	58·0 "

The dimensions of the ash or oak frame are 19 × 7 centimetres. In the drawing, V, is a side elevation of the frame, showing how it is strengthened by means of 6 millimetre iron plates bolted on, the bolts passing through angle plates set in the corners and on both sides of the stay pieces on the

Fig. 3.

inside of the frame. Fig. 1 E shows an end view with the two shaft holes. A pair of chain-hook rings with eye bolts are fixed on either side of the shaft holes in the end stay pieces.

The steel spindle has, of course, a pin hole at both ends, through which the hold-all pins pass and are made secure.

The other appliance, the duct reel, will be found in special cases when laying long runs of few ducts to be more serviceable and certainly safer than the rodding process usually employed. It is a small and light contrivance and needs no attention, while the rods required for a run of, say, 125 metres are weighty, and require two or three men to handle them, and are apt to separate in the ducts—a serious matter.

Referring to fig. 2, the appliance consists of a cylindrical hard wood plug W, if for round tubes, about 30 centimetres long, turned up a little smaller than the diameter of the ducts, and with a conical-shaped head C to fit into the bevelled brickwork of the manhole. A hole of 1 cm. dia. is made through the axis of the plug for a cord or line to pass, and let into the side of it, and fixed by screws, is an angle-shaped iron arm A, to which is attached the reel R by a thin bolt with nut B. The reel disks are about 18 centi-

metres in diameter, made from 3 millimetres sheet-iron, and then galvanised. The core is of wood 6·5 centimetres in diameter by 6·0 centimetres long, to which the disks are secured by radial screws. To prevent the reel from over-turning when the line is pulled, a semi-circular flat spring S bears against one of the disks, while a knob K is attached to the other, near the periphery, to rewind the line back like a fishing reel. All that is necessary then is to introduce the wooden plug into the duct and pull the line forward as the ducts are being laid.

The dimensions of the reel will enable several to be used side by side when laying a number of ducts in the same trench. When the next manhole is reached the cord is attached to the draw-wire to be left in the duct, and hauled back, at the same time being rewound on to the reel ready for the next section.

The size of reel given, with a cord of about 3 millimetres diameter, will hold about 135 metres, which should be water-proofed previous to use.

COST OF LIVING IN THE FEDERATED MALAY STATES.

By ONE WHO HAS LIVED THERE.

The settlements forming the Colony of the Straits Settlements are Singapore, Penang, or Prince of Wales's Island (with Province Wellesley and the Dindings) and Malacca. The settlements are on the Straits of Malacca.

The great bulk of the population are Chinese, Malays and Tamils, there being also Bengalis, Patanis, &c., and comparatively few Europeans.

The climate of the Colony may be said to be quite uniform throughout the year, and the foliage is perennial, but owing to its dampness the climate is very enervating, and it is hot, the average temperature indoors being 93° F. during the day, and much more of course in the sun, while at night an average temperature of 82° F. is experienced.

To combat the heat and guard against sunstroke it is necessary to wear a thick pith topi (sun hat) and use a Chinese umbrella, and to protect the eyes from glare a pair of blue goggles are an advantage.

The houses are mostly of wood raised from the ground on piers and they are of the bungalow type, very spacious and comfortable. These are generally granted free by one's employer in the native States and, as a rule, a bachelor's quarters comprise one bedroom, with bath-room annexed, one sitting or drawing room, pantry and veranda; the kitchen, boys' rooms and stables stand away from the house. The houses are detached and generally stand in their own ground, being therefore quite private.

Mosquitos are kept at a distance at night by sleeping on a bed surrounded by a mosquito net and care must be taken if one wishes for perfect rest, to see before retiring that none of these troublesome insects are inside. The sun rises at about 6 a.m. and sets at 6 p.m. all the year round, and if out-door work is to be done, it is well to be up and doing before the heat is too great.

Early tea is usually served about 6.30 a.m., then comes a bath and dressing for breakfast, about 8 a.m.; this usually consists of porridge, eggs and toast, ham or chicken as required, and tea or coffee.

After a morning at the office till about 12 p.m. (if not travelling) comes tiffin (or lunch); this meal is generally made up of soup, curry, chicken and fruit, then after a short afternoon spell at the office till 4 p.m. comes a cup of tea, a bath and a change of dress for the evening, when dinner is served about 8 p.m. At this meal we again have soup, curry, chicken, pudding, &c., and fruit. There is not a great variety in the meat line, chicken being the only real form of meat to be relied upon except tough buffalo meat, which is most unpalatable. There are, of course, tinned meats to be bought if preferred.

One generally feels so done up after dinner that bed is sought about 9 p.m., and often earlier.

The general impression which the griffin (new arrival) receives is that everything goes on so slowly; this is at first irritating, but ultimately one falls into the way of the East, and becomes equally easy going, and after all this is the only way to retain health and to achieve anything, for one cannot hustle in the East. The life is extremely quiet, especially if one is stationed on a tin mine or coffee plantation miles away from anyone and in the jungle, but in the towns things are not quite so bad.

Taking things altogether in this country, I am convinced that one's life is safer, and property, too, than in the towns at home, as if ordinary care is exercised there is not much thieving going on.

House furniture is usually light, and can best be bought on the spot at some sale or other (or even new, the Chinese being fair carpenters and cabinet makers), while the floors are covered with small grass mats or rugs; these are removed daily when the boy sweeps the house, and the harbouring of scorpions and other objectionable vermin is thereby minimised, though bats continually fly through and through the open windows and doors at night.

The clothing is also, of necessity, light, and one must be provided with a good equipment, including evening dress. Say for a start, to provide for one or two changes during the day:—

4 white drill suits at $3.50 (7s.)
4 khaki suits at $4.50 (9s.)
2 flannel suits, say, at $15.00 (30s.)
2 pairs white canvas shoes $2.50 (5s.)
1 topi (sun hat) from $4 (8s.)
6 Indian gauze singlets $2.50 (5s.)

The above are all Chinese made (except singlets) in the native States, and are quite good enough for any one, especially the new arrival, as he will find out, but should European articles be wanted, then our European travellers pay periodical visits and meet one's requirements at a greater cost, but my advice is that one should just purchase what is necessary, say two suits for the tropical part of the voyage out, and leave the rest to be made on the spot, when it is much cheaper.

The average daily garb consists of the following: a sun hat, drill jacket and trousers, singlet and white canvas shoes, nothing else except blue goggles and an umbrella, but these are optional though advantageous.

Servants are either Chinese or Tamil, and can be had from $10 (£1) and upwards per month, but it is better for a bachelor to arrange with a boy to do the cooking and house work for about $15 (30s.). Then one requires a water carrier to look after bathroom requirements and conveniences at $2 (4s.); he also works for others in the vicinity. A dhobi (washerman) will wash either for 4 cents (1d.) per piece or $1.50 (3s.) per month.

If one has a compound and a horse one requires a kabun (gardener) and a syce (groom); these can be obtained at about $9 (18s.) per month each.

Travelling is done by ricksha at 6 cents per mile, or ghassy at 15 cents per mile, or by railway, and there are Government Rest Houses (hotels) *en route* for travellers, at reasonable rates.

A European does not engage in manual labour in this climate, his duties being chiefly supervisory in any capacity.

The workers are Chinese, who are clerks, carpenters, jewellers, servants, cooks, storekeepers, and almost anything; Cingalese, mechanics in railway workshops; Tamils, servants, cooks, clerks and telegraphists, also chief labourers on roads and railways; Bengalis, policemen and watchmen, &c.

One does not see so much of the Malays; civilisation seems to have caused them to retire into seclusion, though they make, in some instances, good clerks and interpreters.

The coinage is the Mexican dollar, worth about 2s. sterling, but its value fluctuates with the silver market; to-day, however, I think most Europeans are paid in sterling, and salaries paid depend upon the nature of the work, a very average salary with free house varying from $150 to $200 (£15 to £20) per month, and I should advise no one to take a billet under $150 per month with free house (a house will cost anything from $40 upwards per month, equal £4).

To summarise the cost of living, I subjoin the following list, which is bereft of luxuries and club expenses:—

	Per month.		
One house boy and cook (combined duties)...	$15.00	£1	10 0
One water-carrier	2.00	0	4 0
One gardener	9.00	0	18 0
One washerman	1.50	0	3 0
One groom	9.00	0	18 0
Bread, 31 loaves at 4 cents	1.20	0	2 5
Table food $1 per day (meat, &c.)	31.00	3	2 0
Paraffin oil, per case, two tins	5.00	0	10 0
Jams, 25 cents per tin, six tins	1.50	0	3 0
Condensed milk, 25 cents, 12 tins	3.00	0	6 0
Tea, Ceylon, 50-cent packet	1.00	0	2 0
Buffalo milk, per month	1.00	0	2 0
Per month	$82.20	£8	0 5

Though the above is quite enough to go on with for the average bachelor, I also give a list of luxuries, *i.e.* :—

Beer or stout per bottle	40 c.	£0	0 10
Whisky, Dewar	$1.20	0	2 0
Gin, Old Tom	90	0	1 10
Aerated waters per day...	1.20	0	2 5
Excellent cigars, per 100	3 50	0	7 0
Burmese cheroots, per 100	1.00	0	2 0

The Straits Settlements mountains abound with plenty of good water, and, generally speaking, the place is fairly healthy to those who take reasonable care of themselves, though it is somewhat trying to ladies.

Single men are usually preferred, but no one should ever think of going to the Straits without a billet already secured, either in the tin mine or in Government service, for there is nothing more deplorable than a stranded European in a climate of this kind.

Malay is the language, and it is understood by Tamils, Chinese, Bengalis; it is easily learnt, and very useful.

NOTES ON TRADE ABROAD.

In pursuance of our policy of placing before our readers information that we are convinced may go far to assist them in maintaining, strengthening and extending their trade connections with Colonial and foreign markets, we commence in the following article a series of notes brought together from a number of sources. No doubt we shall touch here and there on topics for which we make no pretence to newness or novelty, but we need make no apology on that account, as our experience in matters of this kind has shown us that it is necessary to say the same thing again and again before it receives the attention that is its due. Moreover, not everybody sees the thing when it is written for the first time, and it is our hope that in reiterating some of these bygone pieces of advice and criticism, we may play the prompter to more than one spirit in the electrical industry who will profit by reason of the notes being new to him, however ancient they may appear to be to those who may have read similar passages with apathy and passed them over with incomprehensible negligence.

To no one in this country has the increase in British electrical exports during the last few years been more gratifying than to the editors of the Electrical Review, for ceaselessly have we urged the supreme importance of British manufacturers, engineers and financiers doing everything within their power to stand boldly up against their electrical competitors in all markets, whether in the Far East or in Canada, in South America or in "the Antipodes." Modestly we dare take a certain credit to ourselves for the greater activity of many of our firms, and now once again we take up the same story, and urge these on to still greater enterprise, while we advise others to pull themselves together, bringing all reasonably available resources to bear in the same direction. That the game will prove to be well worth the candle if the undertaking be entered into with sufficient spirit and enterprise, and with the enlightenment that is theirs for the mere seeking, we are thoroughly convinced.

The fact that the powerful electrical interests of other countries are hard at work must, of course, not be ignored, but it is too easy by far to allow oneself to be paralysed with an overwhelming fit of the nerves because of this foreign activity. The electrical manufacturing resources of these rival nations are very large, but so are those of this country—they are, if all accounts be true, far in excess of our immediate requirements—and with the reputation of British manufacturing standing as high as we are continually being told it does in many foreign markets, we have a card of introduction which will at least gain for us a gratifying hearing. And, however great the world's electrical manufacturing capacity, it is interesting to study how great also are the immediate and prospective electrical needs of the world. It is idle to say that all the "plums" have been secured, and that there is little worth trying for now. They seldom, if ever, will be secured by those who do not make an effort to obtain them, and while we do not like the saying that "electricity is in its infancy," we certainly do believe that the electrification of the world has only just begun. The future electrical trade of the world is as much with the British exporter as with any other if he will only take possession. We are glad to receive weekly evidence that this lesson is being learned, and that here and there capable men are being dispatched from headquarters to establish suitable foreign organisations and secure business to fill up the vacant spaces in English factories.

We are the more glad that this is being done, because alternating with these evidences of new effort Colonial visitors arrive and express to us here in unmistakeable terms their own and their fellow Colonials' views concerning the lethargy of the British electrical manufacturer. It is positively their idea that we do not care whether we have their business, or whether it goes to somebody else. Is not the time fully ripe for a general effort to show them that we care a great deal more than they think? The political advice so often given to us as Englishmen to "Think Imperially," is too narrow a conception altogether for the present-day manufacturer. He, of all men, in his business must "Think Worldwide," "Think Internationally." Think Colonially, think Imperially, of course, but think also in Chinese, in Japanese, in Russian, in Portuguese, even think in the mind of the Fatherland, and of the States, for these, too, we can compel to buy from us in certain electrical lines if we only watch well the opportunities, take our courage in both hands, and make the things that are needed. In this subject we are optimists or nothing. We were optimists before, because of what we had heard and seen and experienced. We are optimists now for the additional reason that British electrical firms have begun to taste blood in the markets of the world, and have in their own books, and in their own works, very practical evidences that they are experiencing the same things that had come along our way.

The man who is interested in his export trade must be often brooding over a big map—not the small map of the British Isles that we sometimes see on the walls of factors' offices with this, that and the other town marked off as the place where an agent or a branch is located. That is all good and essential, of course, for the provinces must be well nursed, but the "Home Trade" man must keep that running smoothly, and always up to the pitch of excellence. The export man must have a map of the world, and other maps besides, of all the different continents and countries, and they must be used very much as the boy or military novice used his maps of South Africa during the Boer war, indicating by little flags, the advance from post to post as our forces went onward to victory. In too many offices are such maps absent! We believe that, if more of this obtained, together with much of the kind of thing it indicates, the exportation of electrical goods from the United Kingdom would advance at a far greater rate than it has yet been our pleasure to record. But the close study of the world maps, while it is bound to be always important, is also but an elementary part of the matter, for if our interest once aroused be not sustained and carried on to skilled organisation and determined effort, if it end at a mere academic study, with little beyond a sigh at the vastness of the untilled soil, there will be no practical value resulting. We may slumber again and have to put up with a casual export order for a few small lines, or for one or two motors, where we might have had a large *clientèle* with substantial and frequent requirements for quantities of stuff, both large and small.

It is not our intention to attempt to tell manufacturers how to set about establishing an export department. That

is not an overwhelming difficulty once the right spirit is there, for it is not as though Englishmen were strangers to export work, and there is no scarcity of men who have had experience in such matters. There must be the right man or men abroad, and the correspondingly right men at home to see that correspondence, cables, inquiries and orders received are promptly and efficiently handled. The Export Department, further, is not one the expenditure upon which can be stinted. The employés will not be long in catching the "wide world" spirit once their superiors are thoroughly imbued with it. It will extend right down to the small boy who will have a wonderful admiration for his chief as he searches the office basket between or after hours for foreign stamps.

But without any further generalisations and with our world map open before us, and a pile of useful documents at our elbow, we will proceed to particularise on points that have been advanced by authorities.

Sources of Foreign Trade Information.

We have frequently been impressed with the value of the American Consular report, and have made a more or less close study of these daily and monthly documents for some time past. As our readers know, we make a regular practice of publishing extracts from British and some Continental Consular trade reports in our "Business Notice" pages, and in the following notes we shall select from the American reports a variety of points worthy of electrical notice from Englishmen. The fact that they were written by those making a study of the world through American spectacles in order to assist the American trader does not deprive them of educative value to the Englishman, for we can benefit by what our rivals are advised to do and by the corrections that are administered to them. Perhaps, indeed, we may be the better able to see where we stand ourselves, or ought to do, by perceiving the positions occupied and how they are held or lost by others. Further, by observing the faults of others, we may be led to indulge in heart-searchings out of which nothing but good can come. While admitting the superiority of the American Consular report service in general, and wishing that our own Government would, as we have frequently urged, double or treble its expenditure upon such efforts to assist our trade abroad, it would be an unpardonable sin to overlook the usefulness of the Commercial Intelligence Department of the British Board of Trade. We doubt very much whether our electrical firms in search of assistance make all the use that they might do of this Public Department. The very *raison d'être* of these offices is to render such assistance, and we are sure that applications for information regarding the outer markets, if addressed to those in authority in Basinghall Street, E.C., and at the various provincial offices, will not be in the least regarded as intrusions or trespassings, but will be courteously treated to the full limit of the official ability. While on this question of Governmental and Consular assistance, we may mention a suggestion recently forthcoming from the American Consul at Durban. He advised American exporters to file their cable addresses in consulates at a time of sending catalogues and price lists, and quoted an instance showing the usefulness of such a practice, or rather the folly of leaving it undone. A Natal firm desired to purchase a rather expensive plant, and they knew the name of the manufacturer, whose name was also found in various commercial directories in the consulate, but nowhere could the cable address be found. Other instances of a like kind had come under this same Consul's notice. The importance of firms including their cable addresses with the other information in trade directories was also pointed out. It seems strange that such advice should have to be given to Americans, so proud of smartness and alertness, but it is one more interesting commentary on the similarity of the whole human family in proneness to err at times. The desirability for seeing that one's foreign addresses are indicated in advertisements in trade journals was recently drawn attention to by one of our own Consuls in Australia, and was emphasised in the ELECTRICAL REVIEW. We hope the point will not be lost sight of, so while touching on so many other matters, we name it here again.

Before leaving this part of the subject, we may mention that the Bureau of Manufacturers of the Department of Commerce and Labour has arranged for filing with United States Consuls a card index whereby the Consulates may forward the export of American goods. The *Electrical World*, in announcing the decision in June, said: "Major John M. Carson, Chief of the Bureau of Manufacturers, announces that any manufacturer desiring to take advantage of the plan should communicate with him. No fee is to be charged for the service in sending out cards to the Consulates. All that is required of the manufacturer is that he print his cards in the language of the country to which they are sent, and in a prescribed and uniform size for assembling."

We quote this as an illustration of the extent to which American Consuls co-operate in more or less a matter of detail in keeping traders informed. When we are given to blaming defects in the Consular service provided by British representatives we, as traders, must see to it that we are not ourselves to blame in omitting to make full use of these representatives. The trader should let it be known what kind of information he is in need of, if he does not already find what he requires in the Consular reports as published. Though there are of course limits to what can be done without a substantial increase in the Government financial allocations for this class of service, we believe that more might be done than is done at present if Consuls were more frequently appealed to.

Another point of interest, and one to which the attention of the Government has lately been directed by questions in the House of Commons, is the nationality of our Consuls, and the effect that such may have upon the amount of zeal with which our trade interests are watched over. The case of Germany may be cited. Sir E. Grey, replying to Sir Gilbert Parker, said that the number of British Consular officers in the Fatherland was 34, of whom six belong to the salaried service, and these salaried officers are all natural born British subjects. Of the remainder, however, only six were natural-born British subjects, 20 were born and had remained German subjects, one was a naturalised British subject of German origin, and one a naturalised United States citizen of German origin. It was explained that office allowances were made for unsalaried services where the trade did not justify the appointment of salaried officers, and that British subjects were appointed where their services were available. On a later date, further questionings relating to our Consular representation at Kiel, and as to the possibility of having an English subject as unsalaried British Vice-Consul there, instead of a German subject as at present, led Sir E. Grey to say that the primary reason for appointing Consular representatives was to look after trade and commercial interests but they could not be appointed unless a foreign Government was willing to accept them. The Government could not ask for an appointment for special reasons in one place more than in another. No doubt we shall all feel that the interests of British trade are more likely to be well served by people of British blood and birth whose hearts are bound up with ours at home, but we believe it has been stated lately that the principal exporting countries are all in pretty much the same position in this respect. That it is recognised in high quarters as being undesirable would appear from the willingness to alter it when convenient opportunities arise. We believe, however, that it is a fact that the convenient opportunity is only the death or promotion of the existing holder of the appointment. This inclines us to hope for many openings for promotions, for it is, to say the least, unsatisfactory that British trade should have to continue long dependent upon gentlemen who, however well intentioned, are hardly to be expected to go very far out of their way to assist the manufacturers of another nationality. We fully recognise that other nations may suffer under the same grievances when they are dependent upon foreign-born representatives, but this only serves to emphasise the unreasonableness of the position as it now stands. We suppose the question of expense is largely responsible, for the salaried officers in Germany are all British, and it is only where the trade is not considered sufficient that unsalaried officers are good enough. If that be so, increase the vote and negotiate with other powers a mutual interchange of consuls without waiting for the death or promotion sentence. Special trade representatives in all the markets of the world are what this country needs; not "unsalaried officials," but men adequately

paid for exclusively collecting trade information, advising manufacturers, and replying to inquiries. No doubt the higher diplomatic agents may possess facilities and qualifications which shall fit them for doing us an important good turn because of the valuable opportunities they have for coming into close official and social intercourse with eminent individuals, but important as these are, might they not be supplementary to those of the special trade agent? The latter would still be a subordinate official of the former. There is something to be said in favour of information being collected by a man already engaged in trade in the particular vicinity, but human nature being what it is, there is also something to be said against it. An independent official in the service of the Home Country—that is the ideal, but the cost! As to that, we have already stated that it would be an investment well worth the nation's while. Governmental assistance of this kind is to our mind perfectly legitimate.

No doubt there is some settled basis, some trade minimum, which decides whether a salaried or unsalaried official is to be allowed, and if that is so, then it means that British trade must first be privately developed up to a certain figure, when it shall have a salaried official to foster it. This may be all right to some minds, but would it not be somewhat wiser to go one better and let the British trading potentialities of a particular province, as well as what has been already achieved, carry weight? To extend British trade is the moment's need; once we have reached a respectable figure, British firms can do a great deal to maintain that figure year by year.

Let it not be imagined that we desire the Consular service to do that essential pioneering work which private enterprise has done in the past, but there might be more of the latter if the former were more efficient, and an improvement in both directions would tend to lessen our home unemployment.

We ought to add in this section that in addition to the facilities provided by the Board of Trade, there is a Statistical and Information Department of the London Chamber of Commerce, 1, 2 and 3, Oxford Court, Cannon Street, E.C., where, *inter alia*, it is possible to ascertain names of the principal agents and importers of electrical goods in certain countries.

Packing for Export.

Not much has been written recently in the Press on the importance of machinery and apparatus being properly packed. Is it because there is no room for improvement? We should like to be able to think so, but there still linger in our memory the letters that have been brought to our notice complaining of the complete hanging up of sadly-needed goods purely because inefficient packing has allowed some small part to be damaged in transit. The whole thing has had to lie *hors de combat* until a new piece arrived in response to an angry cable or a letter, the terms of which are "better imagined than described." American Consuls have belaboured American packers, and English Consuls have scolded our own, for shortcomings in this connection, and have shown how it is the easiest thing in the world to alienate support and to create false impressions. There are circumstances under which even poor stuff well packed is better than the best quality goods so packed that it is impossible to bring them into use when required. The packer is an employé of no mean importance, for remissness or incompeteney on his part may do untold harm. We have little doubt that among those who read this will be some who have a very lively recollection of trouble experienced, of reproofs administered, of diplomatic apologetic letters that they have had to write to wrothful foreign clients. The expert packer must know his business—there is one way of packing oranges to come to England, and quite another of preparing electrical instruments for their journey to, say, India or some other part where climatic considerations are of great consequence. We well remember reading a paper written by an electrical engineer in India, in which the seriousness of the question was dwelt upon. Such contributions, unfortunately, have a way of being forgotten all too soon, so we refer those who may be interested to the ELECTRICAL REVIEW for August 21st and 28th, 1903, where the paper was reprinted ("On the Preservation of Instruments and Machinery in Bengal," by Paul Brühl, read before the Calcutta Section of the Institution of Electrical Engineers). With a view to arousing an interest in this paper in the minds of those who never read it at the time, let up quote a few typical sentences:—

> As we all know to our cost, a good deal of mechanical injury is often done before the goods reach our hands. It is, of course, useless to expect that the treatment accorded by porters and dock labourers or railway servants in Europe, or by coolies out here, to cases containing scientific instruments will be in any way different from the treatment meted out to cases of cotton goods or bales of jute. They will be banged about, dropped from heights varying from a fraction of an inch to 20 ft. or more, rolled down inclines and turned over regardless of any printed admonitions of the type of "this side up." I do not know whether railway porters and dock labourers are more considerate on the Continent than they are in other parts of our globe. Perhaps they are. At least, that is what one would conclude from a printed label on a case which I received some time ago from a Berlin firm of scientific instrument makers. On the label there was a printed request—in German, be it remembered—addressed to "respected gentlemen," officials or otherwise, to kindly keep that side of the box with its face upwards. Now the first glimpse I got of that box was in the Calcutta Customs House at the moment when one of the "gentlemen" with dhoties round their loins and a blackened cloth round their heads was turning it over and over, round any and every direction for an axis of revolution, until every side had had its chance of being "up." Hence the wisdom of the ru'e: "Do not expect any side of a packing case turned any way; do not address people in a language they do not understand, and do not indulge in the vain hope that human beings who cannot read are likely to act according to printed directions." I have seen some rather bad cases of breakages, but luckily for us we on this side of the globe are not quite as bad as our brothers on the western hemisphere, where the most expeditious, though perhaps not quite the cheapest, method of breaking stones is to pack them in a strong box and send them by rail to the next town.

Mr. Brühl then proceeds to discuss points that must be attended to in order to avoid breakage of instruments, in spite of rough treatment. We commend this paper and the discussion that followed upon it to the notice of all exporting firms, not only those interested in the instrument business, but those concerned with all other electrical departments who may pick up points of general value.

A practical article on the export packing question as it affects the machine tool business appeared in an American contemporary (*Machinery*) not long ago, and it may, we think, be profitably quoted from here. It is pointed out by the writer—

> That a box containing a machine tool worth a substantial sum in pounds sterling is of no more importance to a stevedore than one containing dog biscuit. It is recommended that special note should be taken of the thorough way in which the accessory parts are cleated down, and the manner in which heavy parts are supported by the framing. The proper preparation of a heavy machine so as to withstand foreign shipment is costly of time, labour, and lumber, and much thought should be given to the design of package. It must be remembered that in lowering a machine into the hold of a steamer it is quite possible that the box will be suspended with the machine upside down, or, what may be worse, from one end if it is too long to go down the hatchways horizontally. No slender part should be in contact with the thin boarding, as a blow or heavy pressure may be transmitted to the part with bad effect. Points that should be observed in packing machines for export are detailed as follows:—
>
> 1. Dismount all projecting slender parts to save space and to prevent breakage by side pressure. Saving of space is important, as 40 cb. ft. is reckoned a ton even if the actual weight is less.
> 2. Avoid packages weighing more than 4½ tons if possible. The freight rate is much higher for packages exceeding this limit than for lesser weights. Keep all weights less than 2 tons if it can be accomplished without making assembly too difficult.
> 3. In dismounting machines take into consideration ignorance of the parties receiving it, and avoid as much as possible dismounting parts that require careful adjustment for the successful working of the machine.
> 4. Fill all the screw holes with wood or waste soaked in slushing oil, to prevent filling with dirt and rust.
> 5. Tag all parts removed, giving their position or use on the machine.
> 6. Prepare a list of all the detached parts to accompany the machine, which will show if any part has been lost in transit or Custom House examination. Assembled drawings or photographs are desirable also, to facilitate erection.
> 7. Cover all finished parts with a reliable slushing oil to prevent rusting during transit. The salt air and dampness of the sea voyage will attack unprotected finished parts to an extent almost unbelievable by one having known only the protection needed for land transport.
> 8. Build the package with strong skids, floor, and framework, reinforced by through-bolts, if large, heavy machines are to be shipped without dismounting the frames from the legs.
> 9. Support all heavy overhanging parts with cross girts from side frames, and pack accessory parts so that they cannot change position even if the case is overturned.

10. Provide a waterproof roof and board the sides so as to resist driving-storms of rain or snow. Leave an opening 12 in. by 18 in. in one side, the cover of which can readily be removed for Custom House examination. Mark the screws holding the panel so that they will readily be found and removed without damaging the case.

11. Mark the case with the gross and net weight, volume in cubic feet, port of destination, names of consignee and shipper, name, number, and capacity of machine; also designate the top or bottom and the nails or screws that should be first removed in unpacking.

Among other things to be borne in mind is the fact that not all foreign ports or landing places are provided with such ample and efficient crane equipments and other handling facilities as, say, Manchester, Middlesbrough, Hamburg. Also, in many of the mountainous districts in the interior of, say, India or Brazil, there is a complete lack of railway facilities, and the motor-car has not yet found its way there for the haulage of goods, so that mules or oxen, camels or elephants, or chains of native carriers, have to convey to their final destination packages, &c., that have been started from home by the smooth running of a modern electric crane.

On this point an American Consul at Saigon, Cochin-China, after alluding to the gratifying improvement recently noticeable in the packing of goods imported by the Philippines from the United States, adds, according to the *Mining World* (U.S.A.), that while it is not yet all that it may be, it is observed that more care is shown in the selection of stock for the casings. "This is sometimes reinforced, as it always should be, with strap iron bands. The necessity for this is apparent to all who have watched the methods of handling, and especially trans-shipping freight by means of coolies. These, with a bamboo pole and piece of rope, carry in a most precarious fashion practically all sorts of merchandise brought to this region, and the package is liable to drop and burst at any moment. Another improvement noted is in the making of uniform packages instead of placing a number of miscellaneous articles in the same case."

Comments of interest on the packing question were recently made by the American Special Agent Dennis, in Moscow. He says: "In a long and most interesting interview with one of the oldest and most successful dealers in Odessa, he called my attention particularly to that oft-repeated complaint of careless packing. In one shipment of 24 machines 19 of them arrived with a road wheel broken. One only needs to take a walk about the docks of any of these foreign ports to appreciate how absolutely necessary good strong packing is to ensure delivery of goods in saleable condition. When the time necessary to secure repairs for such breakages is considered, it really means carrying the implements (agricultural) all the year unsold."

Inattention to Correspondence.

The American special agent at Moscow, whom we have just quoted on the subject of bad packing, says that in the same interview the Odessa dealer called attention to the great lack of interest evinced by many manufacturers in the United States regarding letters of inquiry sent from Russia. "In many cases no answer is received. In others the questions asked are evidently answered by some one not at all conversant with the technical details of the business, and hence are of little or no value. He felt that the least the manufacturer could do was to convey the idea of his interest in the subject-matter of a letter received, and if it was not in a line of goods he made, he might at least suggest the name of some other maker who would be likely to take it up."

In view of the increasing importance of the Russian market from an electrical standpoint, and the desire that exists there to do business direct with English houses rather than through Germans first purchasing in this country, our electrical traders will do well to note these criticisms of American inattention. It appears that Americans already on the spot are prepared to give hearty support and assistance to other Americans "representing non-competitive lines," who care to make an effort to secure a trade anywhere in Russia, "if they send the proper sort of representatives." This equally applies, of course, to our own countrymen, for Englishmen are only too happy to welcome others of a like nationality, and they may be trusted to cordially render assistance so long as in doing so they are not cutting the ground from beneath their own feet.

The "Proper Sort" of Representative.

We might enlarge on this point as showing how important it is to send representatives of standing, "the proper sort," as the American agent says, with whom those already established there would have no aversion to hobnobbing. The "right man" fraternising with the man already possessed of valuable experience as to the people, their ways and customs, needs and predilections, might be able to learn just those things which would make him able effectively and diplomatically to negotiate for trade or for concessions. Some of our friends who have succeeded in establishing satisfactory connections in Russia for electrical specialities, advocate the appointment of Russian agents rather than sending out Englishmen, because the former knows the Russian game of business, "the ropes," as we say, better. That this will not hold in all cases we can readily believe, if for no other reason than that Englishmen who have lived in Russia for half their lives are doing a splendid business in particular trade lines. No doubt their long residence has brought increasing success as year by year they have won their way nearer and nearer to the Russian because of their close intimacy with him and their ever-improving knowledge of his methods and requirements.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Increased Output of Boilers.

Referring to your article on this subject in your issue of July 9th, it is undoubtedly true that an increase in velocity of travel of the gases in a boiler will increase the efficiency of the heating surface, due to the fact that more of the particles of gas are brought in intimate contact with the surface of the boiler in a given time. The losses incurred in attaining this increase in velocity of the gases, however, far outweigh any gain thereby.

Assuming a fixed rate of combustion, if the velocity be increased by increasing the volume of gas by dilution with excess air, the efficiency is very materially reduced, for the temperature of the furnace varies directly with the percentage of CO_2, or inversely with the percentage of excess air, and the rate of absorption of heat depends upon the difference in temperature between the gases and the boilers. Again, still assuming a fixed rate of combustion, the velocity of travel of the gases can be increased by lengthening the path of their travel by increasing the number of baffles.

By applying the laws enunciated by the U.S. Geological Survey, and quoted in your article, the increase in the number of baffles will increase the resistance, and, consequently, the "pressure drop" between the grate and the chimney, leaving a proportionately smaller "pressure drop" available for the grate. This, of course, would reduce the output of the boiler.

Should we resort to mechanical draught to maintain the output of the boiler, we find that the weight of gas passing through the boiler varies as the square root of the "pressure drop," consequently, the increase in "pressure drop," due to the increase in baffling, will enormously increase the power required to operate the fan. Of course, under these conditions, an increase in output from the boilers would be inexpedient, as it would be attended by abnormal cost of operation of the fan.

The writer is quite prepared to agree with "Scrutator" in his comments in your issue of July 30th, especially in regard to the slow unbaffled travel of the gases through a boiler of the Lancashire type, in which such high efficiencies are obtained.

It may interest your readers to know that some of the largest plants in the United States have entirely removed the baffles from their boilers, which are of the B. & W. type, thus reducing the "pressure drop" between the grate and the chimney to a minimum (see *Proceedings*, American

Society of Mechanical Engineers, December, 1906). These boilers are evaporating from 7 to 8 lb. of water per sq. ft. of heating surface per hour, at substantially the same efficiency as when, with chimney draft, they were evaporating from 3 to 4 lb. of water per sq. ft. of heating surface. They have a ratio of heating surface to grate surface of 40 to 1, and are burning a very poor grade of coal. The terminal temperature is 150° to 250° F. above the temperature of the steam, and the flue gases show 15 per cent. to 16 per cent. of CO_2.

These results are accomplished by the balanced draught system, which is now being introduced in Great Britain and on the Continent. By this system the damper in the smoke outlet of each boiler is automatically controlled by a gasometer damper regulator, which so far throttles the damper that atmospheric pressure is maintained in the furnace chamber at the fire door. This condition is maintained automatically for all rates of combustion, the gasometer being actuated by the pressure of the furnace gases.

The air for combustion is supplied by a type of centrifugal fan blower that delivers a constant volume of air for a given speed, at a pressure varying with the resistance. The speed of the fan (volume of air) is controlled by the steam; the pressure at which the fan delivers the air varies in accordance with the thickness of the fuel bed, and is just enough to overcome the "pressure drop," atmospheric pressure being maintained at the fire door for all rates of combustion.

Careful tests in a plant of 5,000 H.P., which was being operated on the balanced draught system at 100 per cent. overdraft load, showed a steam combustion for the blower engines of less than 1 per cent. of the total boiler output.

The writer has had tests made on upwards of half a million horse-power of boilers, and the results of these tests would tend to confirm the conclusions arrived at by the United States Geological Survey. We also believe Prof. Nicholson's statement to be technically correct, but it is not a feasible method of increasing the output of a boiler.

In order to successfully accomplish this result intelligent consideration must be given to the three fundamental laws laid down by the Commission.

Embury McLean.

London, E C., *August 11th*, 1909.

Naval Voltages.

One of the daftest effusions I have for some time read in your valued journal is that under the above title. Evidently the recent visit of the Fleet to the Thames, has enabled your contributor to visit some small cruiser or an "obsolete." The article is simply silly, and shows both an ignorance of modern "ships," and of modern naval electrical matters. It is not worth while attacking the article in detail, but a few remarks may be of interest.

Primary voltages have been 60, 80, 100, and the present 220; 200 has never been used, but 500, for arc lighting many years ago, had a brief trial. (The above is exclusive of submarines.)

Your contributor's knowledge of searchlight practice is about 20 years stale. A modern ship will carry 10 or 12, or 24 (*i.e.*, twelve twin) searchlights. There are several types. "Wireless" is a fairly recent innovation, and was taken *back* to 80-volt ships. There are probably 100 to 150 motors, varying in horse-power from tiny $\frac{1}{10}$-H.P. fans to 180-H.P. capstans.

Generators are both oil and steam (reciprocating or turbine) driven, are compounded, and arranged for parallel running, and are either 60, 105 or 210 KW., with voltage and ampere margins. Lighting will probably total 1,200 to 1,600 points, and has its peculiarities. There are a goodly number of arcs, exclusive of searchlights.

Motor-generators, both A.C. and D.C., will probably total 20 to 30, and include interesting special machines. Other uses of electricity are telephones, bells, gun firing, gun telegraphs, gun alarms, torpedo gear, wireless, heating, &c. Battery power has practically ceased to exist. Small secondary batteries have some uses.

Apparatus is installed in many modern ships that would create a load of near 1,000 KW. (this figure is, however, not attained either under peace or war conditions).

In conclusion, may I ask does the contributor imagine an installation costing possibly £130,000, is produced in the amateurish haphazard way the article would suggest? If he would, or could, but get a real show round a modern ship, he would, I imagine, be a very surprised man, and would at least acquire a knowledge, enabling him to write common sense, and an article that was not an insult to shipbuilding firms and Admiralty staffs alike.

The influence of modern Admiralty practice is easily observable in very many works, but it must be stated that manufacturers do not nearly understand the curious conditions obtaining on a warship, and are inclined to think some specified requirements absurd, &c. Possibly some are.

H. P. B.

The Automatic Transformer Switch.

In your last issue was published an article by "Student" on the above subject. Without necessarily agreeing with the argument put forward, I think most people would agree with the first conclusion, viz., that the only person who will benefit by an auto-switch would be the user of the small transformer.

On the basis of the 500-watt transformer, with a no-load loss of 10 watts, it is shown that a saving of 23s. per annum may be effected, assuming the supply at 4d. per unit.

In practice, I think it would be found that the saving is more than this, for the average figure given by the transformer makers for no-load losses on this size of transformer is nearer 15 watts, and again the average price for electrical energy is higher than 4d. per unit.

Then, again, it must be understood that the no-load losses guaranteed by the makers are presumably correct figures, as indicated on an instrument suitable for such measurements. The ordinary house meter working at, say, 1/150 of its normal load, is certainly not a suitable instrument to accurately measure this small amount of energy, and I think it would be found that most meters read fast (some as much as 50 per cent. fast) under these conditions.

Under the circumstances, I think that money spent on an automatic transformer switch shows a better return than if spent on a better quality iron in the transformer.

As regards the reliability of the auto-transformer switches, it will be noted that some makers supply these with a glazed front, so that it is very easy for anyone to see at a glance whether the apparatus is in working order.

There are many disadvantages in connection with the hand-operated switches, on the primary side of the transformer, for disconnecting the transformer from the supply mains when no lights are required, and when this is taken into consideration, there is much to be said for the automatic transformer switch.

The great drawback at present to the more general adoption of these auto-switches is the comparatively high price, which "Student" places at about £3 each, although there is at least one such apparatus on the market which may be obtained for 32s. 6d. (subject), and the writer has one of these installed which appears to be quite satisfactory. With a reliable auto-transformer switch at a popular figure, I think there can be no doubt as to the advisability of its installation, and it will be noted that the cost of the apparatus would be saved in less than 12 months.

Engineer.

London, *August 16th*, 1909.

The remarks by "Student" in your last week's issue on the above subject are undoubtedly interesting, and from the supply engineer's point of view, will, no doubt, be fully endorsed, but from the standpoint of the contractor, who has to deal with the complaints of customers who are not saving the 60 per cent. or 70 per cent. so much advertised by metal-filament lamp and transformer makers, it will not appeal with equal force.

Users of transformers, such as hotels, &c., whose full load is a heavy one, but who, as "Student" remarks, have use for only two or three lights during the daytime, would be well advised to have a small transformer capable of carrying the two or three lights referred to, the no-load losses of which would be negligible, and to have an automatic switch in use with the transformer carrying the big load.

It is not at all clear what "Student" means by "exercising a little economy in the quantity of energy consumed." Although the percentage of losses on the large transformers will be slightly lower than on the smaller sizes up to 1 KW., yet the losses on, say, a 3-KW. transformer will be anything from 40 to 70 watts. Assume an average of 60 watts loss, which is by no means unusual, this would, on the same lighting hours as estimated for by "Student," 1,170 watt-hours, and at 5d. a unit (which is more like the average cost of current than 4d.), be equivalent to £8 18s. approximately lost during the year. It appears from this showing that a transformer switch costing even, say, £4, would well repay the outlay.

Your correspondent also makes no allowance for the loss of efficiency in transformers through ageing of iron; of course, the best English made transformers do not age appreciably. On sizes up to 500-watt output, the cost of the transformer switch would take from one year to two years to repay, but that it will pay good interest on the capital outlay involved is obvious, even on the figures given by "Student."

"Student" must have been very unfortunate in his selection of an automatic switch when he states that good working is a "rarity."

The transformer switch used by the writer "speaks" for itself, as at the moment of switching on there is evidence of contact being made in the lighting up of the lamp, which, though in no way detrimental to the user, is satisfactory evidence that the switch is fulfilling its function.

Your correspondent's recommendation to use two-way switches, one in the hall and one upstairs, may have advantages, but the possibility of trouble and inconvenience would be much more likely under this system than with an automatic switch which can be operated from any room in the house.

It would be interesting to know what the effect would be in the case of burglars, or illness, or fire, and all other occasions on which light is instantly wanted, if one had to run to the landing to turn the switch on. "Student" states that "we cannot afford to run risks," but he could hardly "look before he leaps" if he has to go to the landing first to turn his light on.

This being the case, it appears to the undersigned that facilities for switching the light on at any point in the house, at any time of the day or night, which is the case when using an automatic switch of good construction, far outweigh the slight disadvantage of a few shillings extra cost over the two-way switch system, and, as before pointed out, there are a very large number of cases where transformers of from 1 to 5 KW. output are in use in which the cost of the switch is repaid in much less time than a year.

In practice meters generally read very high at 10 watts or thereabouts when the power factor is so low, as with transformers on open circuit, *i.e.*, from ·4 to ·6. This occurred with the writer, who experienced an increase of about 100 per cent. with a meter quite correct at average load.

Climax.

Samples with Tender.

In last week's issue, I notice above the signature of "One of the Tenderers," there appears a letter relating to the submitting of sample arc lamps.

As the communication in question is obviously meant to allude to the specification recently issued by the Swansea Corporation for the supply of arc lamps (88 not 80 as stated), it has occurred to me that the following information may be of interest to your correspondent.

I am strongly of opinion that in deciding tenders for certain electrical apparatus, the only fair plan is to be in a position to examine and test the actual article quoted for. Arc lamps, I consider, in particular come under this class of apparatus. It has been my experience when inviting tenders for arc lamps to have a large number of the manufacturers asking to be allowed to submit sample lamps at their own expense, and it was this fact, coupled with the one above-mentioned, that decided me to make it compulsory for all firms tendering to submit samples, so that their tenders would receive the same consideration.

As the lamps will have to be run four in series, I think you will agree it is more satisfactory to judge of the behaviour of the lamps when burning under the actual conditions required, hence my reason for asking for a complete series of lamps, both D.C. and A.C. It is with sincere regret I now find that in attempting to bring about this fairness in judging the tenders, I am accused of the insertion of an "improper clause."

I have pleasure in sending you herewith a copy of the general conditions and specification, and I feel sure, if you will look over same, you will agree with me that there is nothing "improper," or in any way unfair to the firms tendering. I beg to submit that the merits or demerits of an arc lamp cannot be judged fairly without the lamp being actually examined and tested, and my object in asking for samples from the tenderers was purely with the idea of giving each tenderer an opportunity of having his particular make of lamp judged, not only by price alone, but after the details of construction, &c., had been investigated.

C. A. L. Prusmann,
Borough Electrical Engineer.

Swansea, *August 16th*, 1909.

We are glad to note that you have taken up the matter, in your last week's "Correspondence" columns, of the unreasonable requirements mentioned in a recent arc lamp specification.

We should be greatly interested if the engineer asking for these lamps would state how many firms tendered, and how many lamps were sent as samples.

The mere fact that eight lamps were required as samples does not convey an accurate idea of the total cost to the firms sending in these samples. The lamps were required to be fitted with special cases, an adequate number of carbons for testing purposes free of cost, automatic cut-outs, substitutional resistances and line resistances.

As no indication was given as to the length of time these lamps would be under test, it is possible that they would be returned in a condition unfit for issue as new lamps.

The cost of preparing such lamps for tender would be quite prohibitive in view of the small number of lamps to be eventually ordered.

In cases of this sort, we think it would be well if, when advertising the specification, the onerous conditions for the samples required were clearly stated in the advertisement. This statement would certainly have prevented the preparation of an estimate in order to obtain the return of the guinea by

Another of the Tenderers.

August 17th, 1909.

Testing Condensers for Leakages.

I read with interest the article on this subject by "Harbee" in your issue of August 13th, and I admire the way he tests his feed water for salt.

It is very important to be able to check the starting of a leakage in a condenser when the circulating water is taken from a tidal river where the water is salt, but there is an objection to all leakage tests as far as I know, and that is, they do not give a continual record such as would draw attention to a tube going wrong, unless a test happened to be applied exactly at that time. It is more than likely the first indication would be the feed-water tanks overflowing, and perhaps the boilers priming, due to the large quantity of salt water drawn through the bad tube by the air pump.

Another leakage or loss in a condenser is a drop in vacuum, due to leaky joints, and more often due to dirty tubes. This loss in a turbine station, unless great care is taken, may amount to a serious item in the economical running of the turbines.

It is a good plan to have a barometer in the engine room and a mercury column to each condenser; also means should be provided to take a weekly test of four hours' duration, with 10-minute readings of the load on the turbine, vacuum in the condenser, temperatures of steam inlet, outlet, water inlet and outlet on the condenser, as by these means the engineer has a record of the working efficiency of his condensers.

The writer has several large condensers under his care,

the tubes of each condenser are brushed and steamed out about every four or five weeks, and a water test at a pressure of 25 lb. per sq. in. applied on the outside of the tubes; this pressure is slightly above the circulating water pressure plus the vacuum pressure, and shows up any leakage.

Perhaps some reader could describe a reliable method of detecting salt, and continually recording on a chart, similar to a volt or CO_2 recorder chart, the state of the feed water.

William Middleton, A.M.I.E.E.

Newcastle-on-Tyne,
August 16th, 1909.

Electric Meters.

We have noted with interest the article in your issue of June 18th by Mr. Rankin Kennedy, "Mercury Motor Continuous-Current Electricity Meters," and in your issue of June 25th, by Mr. W. Fennell, on "Temperature Errors in Shunted Ammeters."

Referring to the former article in regard to mercury motor-meters, we take the liberty of sending you under separate cover, descriptive matter in regard to the mercury motor-meters which we have made in this country for a number of years, as we believe this matter may be of interest, since our meters embody some of the improvements that Mr. Kennedy speaks of as desirable, and particularly the separate brake feature. We would also draw your attention to the fact that we have perfected and have manufactured many thousands of A.C. watt-hour meters of the mercury-motor type, these being, so far as we know, the only ones manufactured.

Referring to the other article, by Mr. Fennell, we beg to say that we have devoted a great deal of attention to the matter of eliminating the error produced by thermo-electric effect in the junctions of resistance metal and copper or brass, in shunts with our large capacity D.C. meters, and have overcome this difficulty very satisfactorily by taking the shunt leads off the end blocks of the shunts through long strips of the same material as the resistance metal in the shunt, so that any heating effect setting up a thermo-electric potential between the alloy metal of the shunt itself and the end blocks, is off set by an opposing and practically equal potential set up between the end block and the alloy strip leading off from it to the shunt cable. By having this strip of sufficient length and properly proportioned to dissipate the heat transmitted to it from the shunt, there is practically no thermo-electric effect set up between the strip and the copper in the cable where they are joined together, thus giving very satisfactory results with the combination of shunt and ampere-hour meter or watt-hour meter operated from it, even where considerable difference in temperature exists between the two ends of the shunt.

Sangamo Electric Co.,
R. C. Lanphier, *Secretary.*

Springfield, Ill., U.S.A.,
August 6th, 1909.

Technical Classes Wanted in the Daytime.

It has occurred to me that those people who would possibly use the evening classes of our technical schools most are more or less debarred at present, owing to the fact of being on "shift" work, as, for instance, the great number of power house and sub-station employés of our several large systems here in London.

Many men I have met have expressed the same surprise as myself, that none of the metropolitan technical institutions cater for these men.

I am sure many would welcome any suggestion you would make as to the formation of such classes.

Clifford C. H. Brazier.

London, *August 11th*, 1909.

[The difficulty mentioned by our correspondent has often come under our notice, and is well worthy of the attention of the educational authorities. But unless there is evidence of a widespread demand for a remedy, it is not likely that any active steps will be taken to provide it; we shall therefore be glad to receive the names of any of our readers who are willing to take advantage of such classes, for our own information, and if sufficient support is forthcoming, we shall be pleased to do what we can to further the proposal.—Eds. E.R.]

PROCEEDINGS OF INSTITUTIONS.

The Electrolytic Theory of the Corrosion of Iron.

By William H. Walker (Boston, U.S.A.).

(*Abstract of paper read before the* Iron and Steel Institute, *May*, 1909.)

When a salt dissolves in water, a certain proportion of the dissolved molecules are regarded as dissociated or broken up by the water into component parts called ions. These parts of molecules may be made up of a single atom, or a group of atoms, but, as individuals, differ from real atoms in that they carry relatively large charges of electricity. Water itself is somewhat dissociated into two ions oppositely charged—the positive hydrogen ion composed of one atom of hydrogen, and the negative hydroxyl ion composed of one atom each of oxygen and hydrogen.

Every metal when placed in water, or under such conditions that a film of water may condense upon it, tends to dissolve in the water, or, in other words, to pass from its atomic or metallic condition into its ionic condition. As the atom of metal passes into the water, it assumes a positive charge of electricity, leaving the metallic mass from which it separated charged negatively; this property or escaping tendency of the metal is termed its solution pressure. It is obvious, however, that this action can continue for only a short time; owing to the fact that the mass of metal and solution are of opposite polarity, the electrolytic tension becomes so great that no more atoms can escape to the ionic state, and the solvent action ceases.

When a strip of pure iron comes into contact with water, it sends into the water iron atoms in the form of positively charged ions. Hydrogen as a metal has a much smaller solution pressure than iron, and hence an equivalent number of hydrogen ions plate out on the iron strip (leaving the free hydroxyl ions with their negative charges to balance the iron ions with their positive charges), and an electric current flows from the iron by means of the iron ions to the solution, and by means of the hydrogen ions from the solution back to the iron again, thus completing the circuit. But the deposited hydrogen is a high insulator—a film of gas which offers a great resistance to the flow of the current. Hence, although in the case of the iron strip in water all the conditions for continuous solution are present, owing to the resistance offered by the deposited hydrogen film (called polarisation) the action must cease.

The solution of the iron, in the first instance, depends upon the number of the hydrogen ions present. This number of hydrogen ions, or the concentration of these ions, is increased by the addition of any acid. So weak an acid as carbonic increases the number, but to a relatively small amount; while a strong acid, like hydrochloric or sulphuric, adds to the number to such an extent that the solvent action becomes violent, and the deposited hydrogen comes off as a stream of gas.

It was formerly thought that the action of oxygen as a factor necessary in corrosion was simply to oxidise the iron ions thrown into solution, and to precipitate them as rust. While it is true that this reaction does take place, and is indeed the most striking function that oxygen performs, it is in reality a secondary one, which is simply incidental to corrosion and not a necessary part of the action. Its real accelerating effect is due to the fact that it depolarises the hydrogen which is set free by the reaction, and separates out on the metallic iron.

Before iron can form rust it must first pass into solution, and in so doing cause an electric current to flow from the iron at that point to the iron at some other point; any circumstance which will aid the flow of this current will accelerate the solution of the iron. In other words, any difference in potential which may exist upon the surface of the iron will in itself cause a flow of electricity which will result in a solvent action on the iron. Such differences of potential inevitably result from a segregation or uneven distribution of any impurities which the iron or steel may contain. Hence we should expect that the speed of corrosion would increase in accordance with the percentage of impurities present. It has been found that a steel made under such conditions that the total impurities are reduced to not over 0·05 per cent. resists corrosion to an extent equal to the iron of our forefathers.

Since iron can pass into solution only by assuming the ionic form, and having at the same time an equivalent amount of hydrogen pass from the ionic condition to the gaseous state, the speed of the reaction will depend upon the number of hydrogen ions present in the solution. The effect of free acids has already been noted; but the presence of any material, such as alum or magnesium chloride when subjected to pressure, or other materials which by hydrolysis will form an acid, will also accelerate corrosion.

If, on the other hand, the hydrogen concentration be reduced, the corrosion of the iron will also be decreased. Such a condition may be most easily realised by adding to the water a strong alkali, which, owing to the presence of a large number of hydroxyl ions, decreases thereby the number of the hydrogen ions.

This fact has an important bearing upon the question which has been lately much discussed as to whether concrete will protect iron from corrosion. Inasmuch as Portland cement, when it sets or hardens, liberates a large quantity of caustic lime, which is a strong alkali, and since good concrete is therefore saturated with this strong alkali, the answer to the question must be in the affirmative. Iron or steel will not corrode when embedded in concrete. But caustic lime is soluble in water, and poorly made concrete is not impervious to water. Therefore, if iron be embedded in concrete through which water at any time be allowed to percolate, this calcium hydrate will be slowly but surely dissolved and washed

away, and with it will disappear the inhibiting action of the concrete, and iron embedded therein will surely rust. To ensure absolute protection of the reinforcing members of concrete construction, therefore, such concrete must be sufficiently dense and carefully made to render it practically waterproof. This is not an impossible condition.

The fact that the presence of a metallic iron surface accelerates the corrosion of zinc has an important bearing upon the protection of such a structure as barbed wire fencing or any structure where both an iron and zinc surface are exposed. In making barbed wire fencing, for example, the wire is first galvanised and then wound into fencing, the cross wires forming the barbs being cut at an angle in order to make a pointed barb. This freshly cut surface of iron is thus exposed, and so furnishes just the surface required for depolarising the zinc surface, and thus greatly increases the rapidity with which the zinc coating will corrode. As the zinc coating recedes from the iron surface, the latter rusts on account of the low conductivity of the water film on the two, and hence the explanation of why deterioration of a barbed wire fence always starts at the barbs and travels from there along the strands. It also shows the necessity of protecting those places on a galvanised structure from which the zinc, from whatever cause, has been removed.

Since oxygen is necessary to ensure the continuous removal of the hydrogen film, it is obvious that if no oxygen be allowed to reach the iron through the water, no corrosion can take place. This fact teaches us much regarding the corrosion of boiler shells and tubes. Pitting may be entirely avoided if the air be removed from the feed water before its introduction into the boiler. This may best be done by the employment of an open feed water heater, or, what is better still, a feed water heater connected to the dry vacuum pumps of the condenser. If such treatment is not possible, the air may be removed from the feed water by drawing the water through a closed box containing scrap iron; the oxygen in the water is then used up in corroding the scrap iron instead of the boiler tubes. Or, the oxygen in the water may be absorbed by feeding into the boiler with the water a very small quantity of an alkaline solution of a tannin material. Such a solution of alkaline tannate will break up under the pressure and temperature of the boiler, with a formation of a pyrogallate of the alkali, and this rapidly absorbs the oxygen. Soda ash, or rather alkali, is of course useful, but not because of its effect upon the oxygen content, but because, as has already been explained, corrosion is inhibited by thus decreasing the hydrogen ion concentration of the water.

The author has shown that "mill scale" or magnetic oxide of iron is strongly electro-negative to iron. Since mill scale is insoluble in water and cannot of itself enter into the reaction, its only function must be analogous to that of platinum or other insoluble conductor of this kind, viz., to furnish a surface on which the hydrogen liberated by the dissolving iron can separate and be catalytically oxidised to water again. This is also true of the black oxide protective coatings sometimes used upon iron and steel, as, for example, that of the Bower-Barf process. Just as is the case in mill scale, these coatings are very serviceable so long as the whole coating is intact. But as soon as a portion of the metallic iron is exposed, this portion corrodes all the more rapidly on account of the presence of the surface of scale on which the oxidation of the hydrogen and consequent depolarisation can go on. The inevitable result is that a pit forms at the exposed point and grows deeper and more marked in proportion as the scale is dense and closely adherent to the iron surface. Hence, if it were possible to remove the mill scale entirely from steam boiler tubes, for example, pitting would be largely eliminated, and the life of the tubes prolonged.

Energy Consumption of Tramcars.

By R. S. Pilcher.

(*Abstract of paper read before the* Scottish Tramway Officials' Association *at Aberdeen, May*, 1909.)

The cost of electricity may decide the question of a profit or loss on the working of a tramway system. In Aberdeen the cost of energy averages 1·10d. per unit, and the energy consumed works out at 1·25 units per car-mile, making a cost of 1·37d. per mile run. The proportion of this to our working expenses is 23 per cent., or more than half the cost of wages. This large item of expenditure can be regulated to a very great extent by systematic supervision over the men.

I believe the records of most towns in the United Kingdom and Ireland show an increase year by year in the consumption of energy per car-mile, chiefly owing to track and car equipments becoming older, and the great addition there has been in recent years in the number of top-covered cars in use. I believe the increase through top covers is due, not so much to the actual weight of the cover, as to the extra carrying capacity of the car in wet weather, and in consequence, the greater number of stops that the car has to make in a given time.

In Aberdeen the routes which use the most energy are not always those routes which have the steepest gradients; the speed of the car and the number of stoppages have a material effect upon the consumption.

My own impression is that any system of electric tramways which has no special system of checking energy consumption, will use at least 5 per cent. more energy per car-mile than a system which has a systematic check upon its drivers. Five years ago I experimented on one of the English tramway systems with a view to saving energy, and by instructing the motormen in the series-parallel system of controlling motors and by showing how it was possible to save energy without decreasing the speed of cars, a reduction of over 7 per cent. was made. In Aberdeen I started a similar system three years ago, which has been very successful. In the first place, each motorman is thoroughly instructed in the series-parallel system of control by means of diagrams. The motormen seem to have great difficulty in realising how it is that parallel consumes so much more than series, and especially how the first notch in series and the first notch in parallel consume more than the second and third notches.

Each man is instructed how to use the momentum of his car to the best advantage, and to keep up the same speed with less use of the parallel notches of the controller. The men are also instructed not to run their cars on parallel unless they have sufficient clear space ahead to get the full benefit in speed of the extra consumption.

All the motormen are informed of the cost of energy, and it never fails to impress them, because they previously did not appear to realise that electricity cost anything.

After having been thoroughly instructed in the office, each man is given a printed instruction paper, which shows where he should be running in parallel and where in series, also where he should be coasting. He soon learns the instructions, and gets into the habit of abiding by them. All our drivers are kept to their respective routes, otherwise I could not expect them to know the routes so well. A tactful inspector is put on the road to see that the men carry out their instructions.

Previously to this system being introduced into Aberdeen, the rise in energy consumption each year had varied between 6 and 12 per cent. per car-mile; immediately it was introduced there was a reduction in the first year of 6 per cent. on the previous year, in addition to which the gradual increase was checked. Since then we have maintained the same consumption per car-mile for three years, and as we have been adding to the number of top-covered cars at the rate of six each year, I consider that this is equivalent to a gradual reduction.

During the last few months we have had a few ampere-hour meters in use, one meter being placed on each route, and there has been a further decrease in the consumption of energy. I intend to ask the Committee for one meter for each service car. The consumption of energy on each route is recorded, a sense of healthy rivalry thus being created between the men on each of the routes. Although these meters have only been in use for three months, they have already more than paid for themselves. The main point is to get the men interested in the subject, and when they understand they will certainly reduce the consumption of energy.

In Aberdeen, simultaneously with the introduction of systematic supervision of the drivers, I noticed a great improvement in the time-keeping of cars; also, which is very important, there was a great reduction in motor troubles, the number of armatures in for repairs being greatly decreased. The car repairs last year stood at ·36d. per car-mile, and, I believe, this is largely owing to the reduction in energy consumed.

The Bristol Recording Pyrometer.

By Percy Longmuir, B.Met., and Thomas Swinden, B.Met. (Sheffield).

(*Abstract of paper read before the* Iron and Steel Institute, *May*, 1909.)

The Bristol low-resistance thermo-electric pyrometer is designed to meet the severe conditions of ordinary shop use. Platinum thermo-couples have a comparatively short life when used in flues, gas mains, or similar situations, and even in oxidising atmospheres, such as annealing furnaces for the production of malleable cast-iron, the cost of the platinum thermo-couples, when continuously used, is an appreciable factor per ton of castings annealed. One distinguishing feature of the Bristol pyrometer is the use of an inexpensive thermo-element. The electromotive force of these thermo-couples is much greater than that developed by platinum alloys; hence, a Weston milli-voltmeter replaces the delicate high-resistance instrument essential to platinum couples.

The thermo-couple wires are insulated by asbestos cord, and then coated with carborundum paint, further protection being afforded by means of a metallic tube. The couple wires are comparatively thick (about No. 5 gauge), hence the difficulty arising from variations in the resistance of the thermo-element with varying temperature is almost eliminated.

The various connecting cables are fitted with terminals of special design, by means of which it is almost impossible to connect up incorrectly. One couple actuates both indicator and recorder, hence the former is placed near the furnace, and the latter in any position accessible to the management. The switchbox included in the system contains compensating resistances, so that switching out either indicator or recorder does not affect the reading of the one remaining in the circuit.

The recorder presents many interesting features. The records are made on a smoked chart, graduated in time and degrees C. or degrees F. The chart, set to correspond to the time of the day, is revolved by clockwork, and, at short intervals, is brought in contact with the pointer of a milli-voltmeter actuated by the thermo-electric current. This vibration eliminates friction between the pointer and chart, but the intervals are so short that a continuous line results. The chart gives a 24-hours' record, and is entirely visible, so that at any time temperatures may be read directly from the recorder. The charts are subsequently fixed by soaking for a few seconds in a fixative, and, after drying almost spontaneously, are quite hardened, and may be filed for reference. The net electromotive force produced in any thermo-electric circuit is dependent on the difference in temperature of the hot and cold

junctions. Many instruments are calibrated and supplied to read correctly with a cold-junction temperature of from 15° to 20° C.; others neglect the cold-junction entirely. Bristol has designed a unique "compensator," which will automatically correct for variations in temperature of the cold junction. This consists of a glass bulb with a short stem, into which two platinum wires are fused. These are in turn connected with the bore of the stem by a loop of fine platinum wire. The compensator is placed in the circuit at the cold junction, and it will be seen that, if the temperature rises, the mercury in the bulb will rise up the stem, thus cutting out a certain portion of the platinum wire, and therefore reducing the resistance of the circuit. The compensator is so calibrated that for a given circuit the reduction in resistance just counterbalances the diminution in electromotive force due to the rise in temperature of the cold junction.

The apparatus was set up to record hot-blast temperatures of the No. 5 furnace belonging to the Sheepbridge Coal and Iron Co., Ltd., Chesterfield. A platinum thermo-couple leading to a Roberts-Austen pyrometer is permanently installed in the same blast main, but the two couples were some distance apart.

The recorder commenced on May 26th, 1908, and shortly after commencing, the temperature read from the recorder was 610° C., against 615° C. by the Roberts-Austen instrument. The recorder worked well, and charts are to hand giving a continuous record of the blast temperature up to the end of July. During August the furnace was damped down owing to a strike.

Comparisons made during the test run showed good agreement in readings obtained. The instrument used by the authors was calibrated for a normal cold-junction temperature of 25° C., and had no compensator in the circuit.

The complete installation was removed to the authors' laboratory on September 23rd, 1908, in order to restandardise, and thereby ascertain the effect of continuous exposure in a temperature range of 600° to 700° C. Visual examination of the thermo-couple and protecting tube showed no change in condition. Comparison with a previously standardised platinum-iridium thermo-couple in a temperature range up to 900° C. gave remarkably concordant results.

The results show that under the conditions described the thermo-electric properties of the couple have not been materially affected. Accuracy has been maintained, and the indications are that the couples will give extremely good life. The mechanism of the recorder is admirably suited to works conditions. The real trouble in the case of most recorders, that of vibration and shock, is practically overcome.

TRADE REVIVING.

Our recent comments on the signs of trade revival, and our quotation of the views expressed by different authorities on their own available evidences in that connection, showed a gradual return of that spirit of greater confidence and hopefulness which is so necessary in order that new enterprises may be entered upon, old ones resumed, and a more extensive interchange of manufactures may proceed between the traders of various nations. Since those articles appeared there have been issued two monthly returns of our imports and exports. The June returns showed an advance of £5,585,963 in imports, and £764,836 in exports, with an increase of £1,936,293 in re-exports, as compared to June last year. The July figures show an advance of £3,547,573 in imports as compared to the corresponding month of 1908, while the exports increased by £1,781,515, and the re-exports by £1,063,303. The electrical exports shared in the increases in both months. From many foreign countries further reports have been received showing that trade generally is very substantially reviving, and the effects are being felt here. Important contracts have been booked by British works in the provinces, and new important shipbuilding and other undertakings of our own are actually placed or now being put out to tender. We make no attempt to prophesy, but we hope that this is but the small beginning of a real turn in the tide leading all the branches of British trade and manufacturing back gradually, and without any unwise forcing or booming, to a period of lasting prosperity for employers, and opportunities for honest and contented labour on the part of all classes of the community.

Middlesbrough.—A transporter bridge across the River Tees is about to be provided by the Corporation. The structure is being supplied by the Cleveland Bridge and Engineering Co., and is somewhat similar to the earlier bridges of this type at Newport and Widnes. The travelling car will be operated electrically, either from the car itself or from the shore; it is designed to accommodate 600 passengers and one tramway car.

PARLIAMENTARY.

Tramways Confirmation Orders.—On Thursday of last week the Tramways Confirmation Orders Bill came before the Unopposed Committee of the House of Commons. Mr. Bonner Morris, of the Board of Trade explained that the Order confirmed provisional orders granted by the Board of Trade in the case of Bolton Corporation for the construction of about 3 miles of tramway: Keighley Corporation just over a mile: Morecambe Corporation about 2 miles: Portsmouth Corporation a mile, and the Whitworth U.D.C. about 3½ miles. The Bill was ordered to proceed.

Electric Lighting Orders.—The Bill for the confirmation of orders granted by the Board of Trade in respect to certain towns, on Thursday of last week passed the House of Commons Committee on Unopposed Bills. The measure enables the Chesham Electric Light and Power Co. to include the urban district of Great Berkhampstead and parts of the rural district of Berkhampstead and Amersham within their area; it gives power to the U.D.C. of Cleethorpes to extend the time with regard to the construction of works authorised under their order of 1900; grants an Electric Lighting Order to the Herne Bay U.D.C; extends the area of the Hindhead and District Electric Power Co. to include portions of the rural districts of Farnham, Hambledon, Alton, Watersfield and Midhurst, and grants a Provisional Order to Messrs. Christie Bros., of Chelmsford, in respect to Holsworthy in the county of Devon.

Royal Assent.—The following Acts have received the Royal Assent.—

Electric Lighting Order Confirmation (No. 2) Act, 1909.
York Town and Blackwater Gas (Electric Lighting &c.) Act, 1909.
Preston, Chorley and Horwich Tramways Act, 1909.
County of Durham Electric Power Supply Act, 1909.
Southport and Lytham Tramroad (Abandonment) Act, 1909.
Wallasey Tramways and Improvements Act, 1909.
Folkestone, Sandgate and Hythe Tramways Act, 1909.
Aldershot Gas, Water and District Lighting Act, 1909.
Oxford and District Tramways Act, 1909.
Gateshead and District Tramways Act, 1909.
Central London Railway Act, 1909.
Holywood Tramways Act, 1909.
L.C.C. (Tramways and Improvements) Act, 1909.
West Kent Electric Power Act, 1909.
Torquay and Paignton Tramways Act, 1909.

ENGINEERING CORRESPONDENCE.

[COMMUNICATED.]

A writer in these columns recently touched upon some interesting points in the handling of correspondence on its reception, and it may not be out of place to enlarge the theme somewhat. Viewed in the light of several years' experience of a bulky mail, in and out, it is fairly evident that this is a rather neglected item in the routine of a great many houses. A few instances may be cited; who with anything of a widespread connection does not know them?

There is the one-man firm—often a most desirable customer, be it said—who corresponds on his billheads with bad ink, and worse pen; as his epistles are usually brief, he is to be preferred to, say, the head of the medium-sized concern who writes letters with his own hand. This gentleman is sometimes voluble, and one feels quite dazed after a page or two of it. Then we have the multigraph book enthusiast; the trouble here is that the carbon paper is usually renewed with the book, and at about page 70 the communication is almost unreadable. Again, the hand-written missive, fairly written but press copied; the result is often fearful to behold.

To come to the now more general type-written document, as in the case of hand-written matter, a great source of annoyance is the badly press-copied letter. There is no doubt that the best method of recording correspondence is by means of loose carbon copies, which are made by the one operation of writing. Probably the net saving in time is small, as the sorting and filing of loose copies takes about the same time as copying and indexing in books. We are looking from the recipient's side, however, and the carbon-copy method ensures that the original written matter will be clean and legible. As an abuse of this method may be instanced the inquiry sent to two or three firms in common, and typed at one operation by means of carbon paper. This is all right if the paper is thin or of smooth texture; but some people revel in thick, spongy stationery, so that the second or third impression is often all but unreadable. Finally, assuming that the faults referred to are absent, a large proportion of letters are made tedious to read by poor typing, bad arrangement, mistakes, erasures, alterations and so on.

Now, we cannot judge a firm's standing by their correspondence, for there are those who have elegant stationery and turn out neatly written letters, but leave their ordinary shareholders in the position of Mr. Micawber year by year. It is safe to say, however, that a letter smartly written, properly arranged, and easily read, will command better attention than one exhibiting any of the defects referred to. Such as the latter are not uncommonly put aside until some amount of leisure can be devoted to them.

The point is well worth considering, and a good standard is easily attained. Much rests with those members of the firm who have control of these matters; the provision of a reputable machine,

which should be kept in repair and cared for generally; also a competent and fairly well educated operator—this is where a good deal of the trouble originates, as quite a number of so-called typists are deficient in common knowledge, and often untidy and careless in their work.

There is much variety in stationery. Printing has become such a fine art in these days that nothing more need be said than that it should be possible on receiving a letter to take in the sender's name, address, &c., at a glance—this is the beauty of the stamped heading, which is usually plain and compact. There is no doubt that what is known as quarto or large post is the most convenient size of paper for general use, as the typewriter then has full play and more equal wear, and quicker work is possible. It is also a comfortable size for the recipient to handle, and, not least of all, easiest to file away. As to texture, there are plenty of good papers on the market, and it is possible to write with a machine on almost anything. For general correspondence a firm's letter paper should be invariably of good quality, coupled with the other desirable features referred to.

The all-important thing is the written matter itself, and whatever be the nature of this, it is well worth giving a little attention to style and punctuation. It must be remembered that normally the letter is the accepted means of intercourse, and as such should be a creditable envoy of the individual or combined interests it represents. An excellent rule is to write on a single subject only in any one letter; this undoubtedly makes for prompt attention at the other end. Another useful and time-saving practice is to head each letter plainly with its subject; this will be appreciated if we suppose it is desired to refer to a letter from a firm with whom there is a large correspondence. Much time is lost by having to read through several lines of a letter with no subject heading, to find that it refers to, say, circuit-breakers, when the matter in question is reduction gear.

In conclusion, the object of these few notes is to urge that as those doing business together usually aim for promptitude and accuracy, it is to their advantage to pay some attention to the points here mentioned. Perhaps the idea some writers of uncouth missives have in mind is that quickness of the hand deceives the eye! It might—in any profession other than ours.

STOREKEEPING FOR AN ELECTRICITY WORKS.

By "INTERESTED."

DIFFERENT people have different ways of conducting their business; but when dealing with the stores of an electricity works, the multifarious goods which have to be handled necessitate one method, simple and effective. The following description of a system may prove of service to some readers. It is simple to put into execution, and, whilst including all that is really necessary, nothing superfluous is added.

No. 1.—GOODS REQUISITION BOOK.

Date.	Goods required.	Quantity.	For works order No.	Contractor.	Official order No.	Manager's signature.	Remarks.

No. 2.—STORES ORDER DELIVERY BOOK.

Orders.						Deliveries.											
Date.	Order No.	Name of Contractor.	Materials.	Quantity.	Date due.	Date.	Quantity.	Date.	Quantity.	Date.	Quantity.	Date.	Quantity.	Date.	Quantity.	Completion. Date.	Completion. Quantity.

Below will be found a list of the books and cards forming the system, and following is a narrative description of each explaining the purpose to which it is put, and its position as a unit of the whole scheme:—

No. 1.—Goods Requisition Book.
No. 2.—Stores Order Delivery Book.
No. 3.—Stores Received and Issued Card.
No. 4.—Stores Received Book.
No. 5.—Stores Issued Book.

At first glance these do not present a formidable aspect, but will be found quite sufficient for the purpose. Those readers who are brought into touch with card systems will notice that one set of cards only are used. Some people are rather apt to overdo the card business, with the result that far too many cards are used, meaning a sacrifice of economy.

No. 3.—STORES RECEIVED AND ISSUED CARD.

INWARDS.

Article .....
Quantity .....
Delivered by .....
Date ..... Progressive No. of card ..... Contract No. of article .....

	£ s. d.
Amount charged ..	
Carriage	
Cases	
Less Discount ..	
Total Cost	

The above-mentioned Goods are in accordance with our requirements, and can be placed in Stock.

Rate chargeable in J.O. book £..... Engineer.....

No. 1.—*Goods Requisition Book.*—In this book the storekeeper enters any material or goods required to be ordered, either for new work or to replenish the depleted stock. Whenever necessary the book is presented to the Chief for signature, and a strict rule is enforced to the effect that nothing is to be ordered without first being signed for in this manner. After having obtained the required signature, the book passes on to the office for the official orders to be forwarded. Should the Engineer for any reason refuse to pass an item, the entry stands as a record of the storekeeper's requisition, which vindicates him in the event of trouble arising in the future owing to the necessary goods not being in stock when wanted for use. Ordering the goods, and the manner in which the storekeeper is informed of the material necessary for projected works, forms part of the office system, and is not dealt with here.

No. 4.—STORES RECEIVED BOOK.

Date .....

Order No.	Contractor.	Quantity received.	Description.	Rate.	Price invoiced. £ s. d.

No. 2.—*Stores Order Delivery Book.*—Each day it is the duty of the storekeeper to enter in this book full details of all orders sent out the previous day. By daily reference to the entries, deliveries overdue are noted, and a request is sent to the office for a letter to be forwarded hurrying forward the goods. This is an important book, and a real trouble-saver, as it ensures the goods being in stock when wanted.

No. 3.—*Stores Received and Issued Card.*—Directly anything is received the storekeeper makes out one of these cards, giving details of the quantity, quality and size, and presents it to the head of the department responsible for the ordering of the same, whose duty it then is to examine the goods, and, if satisfactory, to sign the card, thus officially accepting the material. By this arrangement the storekeeper is relieved of any responsibility in the way of accepting wrong or inferior stores. The back of the card is ruled in such a manner as to allow entries to be made daily or weekly, as the case may be, of issues, so that at any time the total on the back of the card subtracted from that on the front (the quantity received) shows exactly what amount should be in stock. A constant check is thus kept on the goods, and when stocktaking time arrives it is only necessary to take the cards and check each article, or number of articles, in stock, with the balance shown on the card. A little time then spent in totalling up the amounts on the cards representing the stock in hand gives the value without delay. Again,

No. 5.—STORES ISSUED BOOK.

Date .....

Issued to No.	Materials.	Required for Job No.	£ s. d.

with these cards in use time is saved when a request is received for particulars of anything in stock, as, by reference to the proper card, the information can be obtained straight away, without counting or weighing the goods. At the same time, by making a note of the packing and cases received and returned on the cards, a record is always to hand for reference at any time.

No. 4.—*Stores Received Book.*—When goods have been officially accepted, as mentioned above, full details are entered into this book also. It forms a permanent record of all deliveries, and is used for the purpose of checking the invoices.

No. 5.—*Stores Issued Book.*—Everything issued from the stores, no matter how large or small, is entered in here at the time of leaving the stores. Once a day a summary is made up from the entries, and the daily totals duly recorded on the backs of the proper stores cards, as stated in No. 3.

Strictly carried out, this system will be found to work well, and, above all, it has the advantage of simplicity. Whether or not the storekeeper gives a number to each size, weight or make of goods, instead of writing the full description every time, is of not much account here. The use of numbers or letters can be readily applied without in any way altering the system or affecting its working. Many different opinions exist as to the advisability of using numbers or letters to represent goods, but that is not a matter for discussion here, and entails almost a chapter to itself.

ELECTRIC CONVENIENCES IN THE MODERN POWER HOUSE.

By W. S. BURGE.

The interesting article which appeared under the above heading in your issue of April 9th, brought to my mind a recent conversation, in which I was assured that the last word had been said as regards power station design, and that we had arrived at a finality that left little scope for the inventive faculties of our station engineers.

As your article makes evident, there is still fresh ground to be worked upon, and I would for a short space touch upon another view of the same subject, namely, the possibility of operating our central station plant under *continual* test conditions, which can be the only possible way of meeting the continuous steam and thermal losses that are always existent in even the best regulated stations.

The data that would generally be necessary for running the whole station under continuous test are as follows :—

1. Coal consumed by each boiler.
2. Total coal consumption.
3. Steam consumed by each engine.
4. Total steam consumption.
5. Make-up water required.
6. Temperature of hot wells.
7. Flue draught.
8. Vacuum on each condenser.
9. Atmospheric pressure.
10. Station output.
11. Possibly, unit output (where the complete unit system is in vogue).

From the above it will be evident that nothing short of a system of operation entailing special instruments for giving this data, can successfully accomplish the operation of plant under continuous test conditions, and so, before proceeding further, it will be well to consider whether the expense of laying out a power station with a view to such a system would be warranted by the economy effected thereby.

Taking the present-day methods of operation, most central station engineers realise that the best of prime movers and steam generators will only work at their highest efficiency when coaxed by the careful regulation of the various auxiliaries on which they are dependent. In many stations the steam units are occasionally subjected to an efficiency test, and on these occasions everything is most carefully looked to and adjusted. The condensers, hot-well temperatures, boiler feed, stoker feed, flue draught, &c., are all working in unison for the best possible economy, and the net result is often surprisingly good. A few weeks after this event the same plant may be working under the same conditions of load, but probably at a much lower efficiency. The reason for this is fairly obvious. While working under test, each piece of plant is made to give its necessary data, and all the regulation and coaxing is based on the information thus obtained, but when the plant is again working under ordinary conditions, the hourly readings of coal feed, feed-water temperatures, condenser discharge, flue draught, feed water, make up water, &c., are not recorded, and so the manipulation of the plant is purely a matter of judgment, and the result is equally a matter of conjecture.

That there are continuous and recurrent losses in all power plant is only too true, and the very lack of sufficient data to make them continuously evident is apt to make one callous of their existence. It is simply the old case of familiarity breeding contempt. What station is there in which a large number of small losses are not continuously going on ? How about low feed-water temperatures, boiler scale, air leakage through boiler settings, dirty flues, unnecessary radiation off steam ranges which might often be isolated but seldom are, hot drainage water running to waste, steam from small auxiliaries heating the air instead of the feed water ? and many other sources of waste, each comparatively small in itself, but, when all taken together over the period of 12 months, surprisingly large ; and I venture to suggest that a system of operation that would bring these losses into continuous evidence, analyse them, and show conclusively when any were eliminated, would be the means of effecting a considerable saving in the coal bill.

One hardly likes to say that power station operation analyses are in a crude state, for fear of stirring up a storm of indignation from station engineers ; but as a case in point, I would merely say that there must be something wrong when there is still endless dispute as to whether live steam feed-water heaters do or do not effect any real economy, and yet this apparatus has been on the market in full use for many years.

The only remedy that suggests itself is to have all the necessary information for running under test continuously recorded, so that at any instant a complete analysis of the working of the station may be seen. With the present methods of operation this is practically impossible, and the life of the charge engineer would be hardly worth living if it were seriously attempted ; if, however, we had a means for *automatically* registering the necessary data for these test conditions, the information gained thereby would be a valuable index as to the result of all regulations and adjustments to the plant, and would show directly any errors that might occur. Further, the cost analysis of the station would be very much simplified—in fact, reduced almost to an automatic operation.

In consideration of the above, the writer has for some years been working upon a system for operating central station plant under continuous test conditions, with a view to producing a machine to print automatically on a daily log-sheet, hourly and summation readings of all the necessary data for continuous test operation. The individual records of coal and steam consumption do not present much difficulty, but the question of taking automatic summation readings from them is certainly more difficult. Thermal readings can easily be transmitted and recorded electrically, as may also flue draught and vacuum readings. When, however, it is attempted to print all these readings automatically on a daily log-sheet, serious complications arise. Another difficulty is that, were such a system put into operation, many details of the power station would have to be designed with a view to adopting the system, and the general lay-out, including coal handling, condenser discharge, feed-water piping, drain piping, &c., would have to be arranged to work in conjunction with it.

In conclusion, I would say that here at last is scope for new and original work to which we might profitably give careful attention. From the electric generator to the network we are able to analyse and isolate with great exactness the very slightest fault, but in the engine-room and boiler-house there is surely room for further improvement.

BUSINESS NOTES.

Annual Outing.—The annual outing of the employés of Messrs. Stegmann & Co., of Clapham Junction, took place last Saturday week, the party journeying to Brighton in the first instance, where they dined at the Queen's Restaurant; in the afternoon various members of the party enjoyed themselves in boating and visiting places of interest in the neighbourhood. In the evening, after returning to Clapham Junction, the party wound up at the Invitation Hotel, where several members entertained with musical selections.

Correction.—In our article describing the "Electric Lighting at Penrith" (Electrical Review, July 16th, page 114), we inadvertently described the producer plant as being of Crossley make. This part of the installation is, in fact, of the "Whitfield" type, supplied by Messrs. Salmon, Whitfield & Co., Victoria Works, Kettering, only the gas engines being supplied by Messrs. Crossley.

Consular Notes.—China.—The Belgian Legation in China reports that the imports into China of electrical materials and accessories during 1907 were valued at 1,168,436 Haikwan taels (about £200,000). At Shanghai in the same period the imports were valued at 406,950 Haikwan taels (about £65,000). The statistics do not give any details as to the nature and origin of these imports. In the provinces round Shanghai, and more particularly in the town itself, a great quantity of electrical apparatus is being used, since in the foreign concessions particularly private and public lighting is chiefly by electricity. In the international concession electricity is supplied by municipal works. During the last summer these works supplied electricity to 3,736 electric fans of various kinds and of about 170 H.P., and to 82 electric motors of a total of 530 H.P. Amongst these motors 40 are used for lifts, the others are used in connection with the cleaning of feathers, the manufacture of cement pipes, refrigerating apparatus, printing, fire pumps, &c. New installations are in course of construction which will utilise several hundred horse-power. The electrical works are in the habit of letting out motors on loan. The cost of electrical energy is 1s. 3d. per unit. The lamps chiefly used in Shanghai are of the metal-filament class of most recent manufacture. The works supply current to 17,194 lamps of 8 C.P. In 1908 they sold 2,391,586 units for private lighting, 445,143 for public lighting, 3,805 for heating, 154,650 for motive power, 1,430,889 for traction, and 206,732 for use in the works, a total of 4,632,775 units. A piece of land situated along the Whangpoo has been purchased with the idea of erecting new electrical works in 1910. Up to the present, motors, apparatus, lamps, boilers, &c., have been chiefly supplied by English manufacturers. The municipal works also supply current for the electric tramways tramways installed by Bruce Peebles & Co. The telephone is greatly used in Shanghai, and a strong company with a capital of 1,000,000 Shanghai taels—the Mutual Shanghai Telephone Co.—serves the concessions and the Chinese town. The number of instruments in use in 1908 was 2 550, and this number is daily increasing. In the French concession the electrical works have been taken over by a company which at the same time exploits the tramways and the waterworks—the Cie. Francaise de Tramways et d'Eclairage Electriques de Shanghai. The apparatus and the boilers for these works were supplied by French firms. The firms in Shanghai chiefly employed in the sale of electrical apparatus are Jardine, Matheson & Co., 27, The Bund; Arnhold, Karberg & Co., 6, Kiukiang Road; F. Pinfold, Nanking Road; Shanghai Electric and Asbestos Co., 4, Peking Road; Porter & Co., 14, Canton Road. The information given above shows the kind of electrical apparatus chiefly used in Shanghai, but as regards prices it is impossible, under the circumstances, to give any definite information, since the houses engaged in the trade do not publish any catalogues stating the prices of the apparatus they sell. They use mostly the catalogues of American and European houses whose goods they sell, using the same prices and taking as profit the commissions and discounts granted to them by the manufacturers. Competition is already very keen in the market, and the best quality only must be supplied if it is hoped to secure trade.

As regards the North of China, the application of electricity is as yet very limited. The Chinese Engineering and Mining Co., of Tongshan and Linsi, have made installations at their mines; there are electric tramways at Tientsin and certain installations of electric light have been made at Peking, Tientsin and at the mines of Lincheng. At Peking the lighting of the Chinese town is carried out by a Chino-Japanese company using alternating current, with the exception of the Legation district which is lighted by a separate service with continuous current. At Tientsin the lighting of the Chinese town and the Austrian, Italian and Russian concessions, is carried out by the Compagnie des Tramways. In the French concession the exploitation of the lighting system is in the hands of the municipality. In the British and Japanese concessions private companies carry out the work, and the German concession is supplied by works in the hands of the Siemens-Schuckert Werke, of Berlin. At the mines of Lincheng the lighting system is of little importance. The lighting at Tientsin and at the Lincheng mines is by means of continuous current, whereas, at the Tongshan and Linsi mines the electrical installation is worked by alternating current with a tension of 2 200 volts. The imports of electrical materials and supplies into Tientsin in 1908 amounted in value to 176,000 Haikwan taels as compared with 110,000 Haikwan taels in 1907 and 98,000 Haikwan taels in 1906. The companies utilising electrical materials and apparatus in the North of China are:—The Chinese Engineering and Mining Co., Ltd., of Tongshan and Linsi; Peking Chinese Chartered Electric Light Co., Ltd., Peking; the Peking Electric Co., Ltd., Peking; the Cie. de Tramways et d'Eclairage de Tientsin, Tientsin; Usine Electrique de la Municipalité Francaise, Tientsin; Tientsin Gas and Electric Lighting Co., Tientsin; Siemens-Schuckert Elektricitäts Gesellschaft Werke, Tientsin; the Tokio Tatemono Kaisha (Japanese concession), Tientsin; Les Mines de Lincheng, Chemin de fer Peking-Hankow, Lincheng. At the present stage in the development of the use of electricity a considerable opening might be found in the North of China for electrical apparatus, chiefly for lighting purposes and spare parts for dynamos and motors. In order to gain a footing in this part of China, it would be necessary to have an agent on the spot. This is the method adopted by foreign firms.

"Tantalum" Lamps Posters.—We understand that the "Satisfied Consumer" design of posters and show cards used for advertising "Tantalum" lamps has not only appealed to the electrical trade in this country, but has found a ready acceptance on the Continent. It has been translated into Russian, German, Spanish and Portuguese, in order that the same idea may be brought before the public mind of these countries. It will be

readily understood, however, that for different countries, an alteration in the design is necessary, to bring it into line with the prevailing types of the country represented. We reproduce here for the benefit of our readers the Russian version of the "Satisfied Consumer," and it will be noticed that the design is similar to the English one, but is made to appeal to the Russian idea of "Satisfaction."

Turin International Exhibition, 1911.—We have received printed pamphlets in English relating to the General Mechanics (IV) and Electricity (V) groups for the International Exhibition of Industry and Labour which is to be held at Turin from April to October, 1911, under the patronage of the King of Italy. The General Mechanics Section is to be sub-divided into two principal groups: (1) General motive machines, power-conveying appliances, lifting and carrying machines and their accessories; (2) operating machines for working metals, timber, and any material employed in constructing machinery. The Electricity Section will have two main classes: (1) Mechanical generation and supply of electric power; (2) Mechanical utilisation of electric power; with the following other classes: Electric lighting, telegraphy and telephony, electro-chemistry, electric power measuring implements, apparatus for scientific and experimental researches. We understand that intending exhibitors are desired to apply to local or District Committee, or to the Executive in Turin for general regulations, programmes, and application forms. Count Emanuele Costa di Polonghera is secretary to the Executive Committee.

Trade Announcements.—Messrs. A. P. Lundberg and Sons ask us to announce that Mr. H. Jackson is no longer representing them.

The Midland Electric Manufacturing Co., Ltd., have appointed Messrs. Loxley & Co., Ltd., Cabinet Chambers, Basinghall Street, Leeds, as agents for Yorkshire.

The Acme Electrical Co. have commenced business as electric lighting, heating and power installation contractors at 248, Stanley Road, Bootle, Liverpool.

The Metallic Seamless Tube Co, Ltd, of Wiggin Street, Birmingham, announce that they are now in a position to supply from stock 25-C.P. high-voltage metallic-filament lamps.

Messrs. Ship Carbons, Ltd, announce the appointment of new officers as follows: Mr. James Veit, secretary; Mr. F. B. Pell, sales manager.

Bankruptcy Proceedings.—Herbert Shuttleworth, electrical engineer, Cross Court, Briggate, Leeds.—First meeting, August 25th; public examination, September 14th, both at Leeds.

L. W. de Grave, electrical engineer, Derby.—September 1st is the last day for the receipt of proofs for intended dividend by the Receiver, Mr. F. Stone, 47, Full Street, Derby.

Catalogues and Lists.—The DAVIS ELECTRICAL CO., LTD., 17, Moor Street, Charing Cross Road, W.C.—Illustrated and priced leaflet relating to a new high efficiency lamp for 200 to 260-volt D.C. circuits, which is adapted from the Nernst principle; also a priced leaflet regarding the "Delco" metal lamps.

THE ELECTRICAL CO., LTD., 121-5, Charing Cross Road, W.C.—18-page list giving general descriptive information, with tabulated data and prices, concerning their three, two and single-phase induction motors up to 6 H.P., and starters and switches; also a folding card giving prices of Aegma metal-filament lamps, for from 20 to 260 volts and from 5 to 400 C.P.

MESSRS. DICK, KERR & CO., LTD., Abchurch Yard, E.C.—New edition of their catalogue of crane motors and controllers. In the course of some 18 pages these manufactures are described and very fully illustrated photographically in the firm's usual admirable style, the motors and their parts being briefly particularised, together with a schedule of rating and net weights and dimensional details, while the metallic shield blow-out controllers for crane and hoist work are similarly dealt with.

AMERICAN ELECTRIC FUSE CO., Muskegon, Mich., U.S.A.—Several lists describing respectively the Michigan spark coils, American black enamelled wire, the American igniter, and the Allen-Bradley rheostat and electric controlling apparatus.

MESSRS. LOUIS DERNIER & CO., 23, Newman Street, Oxford Street, London, W.—We have received from this firm a beautifully prepared catalogue of silk lamp shades suitable for all purposes. The illustrations are from actual photographs, and they have been executed in splendid style, showing the shades off most effectively. Among the special electric lines are shades for pendants, for Osram and tantalum lamps, for table standards, candle fittings, floral electric shades, and various other beautiful designs.

C. SCHNIEWINDT, Neuenrade, Westphalia.—Two new catalogues (one in English, the other in German), describing his asbestos-woven net resistances. Well arranged tabulated particulars of dimensions, weights, &c., of resistance wires, also prices, &c., of rheostat and motor starter and resistance nets, resistance bands, controller resistance nets, woven wire resistance bands and grids, and electric heating nets are included, with illustrations. In the German catalogue a number of heating and cooking utensils are shown.

MR. G. WUTHRICH, Oswaldestre House, Norfolk Street, W.C.—Two illustrated leaflets containing descriptions of his latest direct and alternating-current machines—D.C. motors and generators for small outputs (starters and regulators), and single, two and three-phase asynchronous motors for small outputs.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price list No. 220 contains brief descriptive notes, with many illustrations and tabulated price information, relating to their "B.T-H." tungsten lamp fittings and accessories. The fittings, which are suited to shop, ship, hall or club room lighting, have been developed for the purpose of running these tungsten lamps in groups, so that a powerful light, equal to that of a small arc lamp, but softer, can be obtained without carboning and trimming troubles. They are made of copper or zinc with a standard of oxidised copper, and the globes which are supplied either plain or pocketed, are of flint glass, ground on the inner surface.

Private Meeting.—A. KEARTLAND (trading as A. Keartland & Co.), electricians, 16, Birchills Street, Walsall.—A meeting of the creditors herein was held recently, when a statement of affairs was presented showing liabilities to trade creditors £280, cash creditors £50, and bank £65, making a total of £395. The assets totalled £224, and disclosed a deficiency of £171. The debtor, it appeared, started to trade in partnership with a Mr. Guest in 1905, but the partnership was dissolved in the July of the following year, the dissolution being gazetted, and Mr. Guest receiving as his share for going out, the sum of three guineas. Since that time the debtor has carried on business under the style of Keartland & Co. The debtor's brother has prepared balance-sheets, and these show that a loss of £145 was incurred in 1907, while in the following year the loss was £270. In 1907 the debtor's drawings from the business amounted to £178, but in the next year he only drew £65. During the present year the takings have only amounted to 24s. a week. The debtor put a sum of £1,000, which he received from his late father's estate, into the business, and this money has disappeared. In reply to questions, the debtor admitted that he had been losing money practically from the start. It was eventually resolved that a deed of assignment should be executed to Mr. Poppleton, of Messrs. Poppleton & Appleby, together with a Committee of Inspection, consisting of three of the principal creditors.

Japan-British Exhibition, London, 1910.—We have received from Mr. Charles I. Kiralfy, on behalf of the Committee of the Japan-British Exhibition, a copy of a letter signed by H.R.H. Prince Arthur of Connaught, as honorary president, and his Grace the Duke of Norfolk as president, in which it is mentioned that next year's Exhibition at the White City, Shepherd's Bush, is to be held under the auspices of the Imperial Government of Japan and with the cordial approval of the British Government. King Edward has recently expressed a hope that both the Japanese and British people will come forward to promote an undertaking which has for its object an increase in the commercial prosperity of both countries, and the uniting still closer of the bonds of fellowship which already exists between them. The Emperor of Japan has also telegraphed his congratulations on the inception of the Exhibition, and expressing his sincere wishes for the complete success of the undertaking.

His Excellency the Japanese Ambassador recently spoke of the intense interest taken in the Exhibition by the people of Japan, and of the large sum of money voted for it by the Imperial Diet. The Lord Mayor of London has pledged his official and personal support, and expressed the conviction that nowhere would more real interest be taken in the Exhibition than in the City of London. It is stated that the full support of the London Chamber of Commerce and of the Associated Chambers of Commerce of the United Kingdom is also assured. The hon. president and the president of the Exhibition request us to invite universal support for this specially important demonstration.

"The unique character of the Exhibition is sure to attract multitudes of people, not only from Japan and the United Kingdom and the Colonies and Dependencies, but from every European country and from America, and cannot fail to increase the commerce of the two nations and to create new commercial channels between them and the rest of the world. We therefore trust that the manufacturers and producers of this country, as well as those of the rest of the British Empire, will rise to the occasion by displaying the best of their respective productions in arts and industries, so as to make a representation worthy of this great opportunity."

Dundee.—The Corporation invites offers for the purchase of two tramway locomotives.

Book Notices.—We are asked to state that at the sale of effects in *re* C. H. W. Biggs in bankruptcy last week, Messrs. S. Rentell & Co., Ltd., of 36, Maiden Lane, Covent Garden, W.C., purchased the stock of the following books:—"Exercises in Electrical Engineering," by Magnus Maclean; "Novice's Guide to Electric Car-Driving," by E. W. Elsley; "The Electrification of Railways," by Prof. Gisbert Kapp.

"Steam Power Plant Piping Systems." By W. L. Morris. New York: McGraw-Hill Book Co. London: Hill Publishing Co., Ltd. 1909. Price 21s. net.

"Wireless Telephone Construction." By N. Harrison. London: E. and F. N. Spon, Ltd. 1909. Price 1s. 6d. net.

"Drawings for Medium Sized Repetition Work." By R. D. Spinney. London: E. and F. N. Spon, Ltd. Price 3s. 6d. net.

Dissolutions and Liquidations.—THOMAS PARKER, LTD.—A meeting is to be held at Lich Gate, Wolverhampton, on Friday, September 17th, to hear an account of the winding up.

JOHN BLAIKIE & SONS, brassfounders, electrical engineers, &c., Littlejohn and Union Streets, Aberdeen. Mrs. H. R. Blaikie, or Williamson, has retired from this business, which will be continued under the same name by Messrs. F. & D. B. Hislop.

LIGHTING and POWER NOTES.

Aberdeen.—At a meeting of the Aberdeen T.C. the convener of the Electricity Committee—Mr. Henry J. Gray—proposed that the engineer be authorised to purchase, for hiring out, a further stock of electrical heating and cooking apparatus for the department. It was mentioned that the experiment had met with more success than was anticipated, and that all the revenue possible would be necessary to make up for a serious deficiency that was expected in the matter of consumption of current in consequence of the new lamps. Objection was made to the proposal by Mr. Robertson, who thought that a further inroad was being made into the province of the private trader. On a division Mr. Gray's motion was adopted by 18 to 12.

Amble.—At a meeting of the U.D.C., on the 11th inst., the question of lighting the town with electricity was considered. A special committee submitted a report, including a provisional estimate of expenditure and revenue, which put down the initial cost at £5,000, which would include site, buildings and machinery. It was decided to send out a circular to ascertain the probable demand for the electric light, and upon the result of this vote will depend what course will be adopted. Amble is situated on the coast in North Northumberland, being seven miles S.E. of Alnwick. The population was 4,428. There are two collieries, and fish curing is one of the main industries.

Barnsley.—A L.G.B. inquiry was held on August 10th into the application of the T.C. for a loan of £3,000 for E.L. purposes. There was no opposition.

Cookstown (Co. Tyrone).—The scheme for the electric lighting of this town was discussed at the last meeting of the Urban Council, and was postponed till the September meeting.

Continental Notes.—GERMANY.—The Nisterthalsperre Gesellschaft is about to put down a plant at Hachenburg (Hessische-Nassau) to utilise certain available water power in the generation of electrical energy for lighting and power purposes.

ITALY.—A company has lately been formed in Milan with a capital of £8,000, and the title La Societa di Elettricita di Abbiategrasso e Limitrofi, to supply electrical energy for lighting and power purposes to the little towns of Abbiategrasso and Casorate Primo.

Dundee.—Work in connection with the submarine base is expected to be finished by the end of the month. The cables for the supply of electricity for power and lighting are now laid.

Glasgow.—The report of the Electricity Committee recently published, contains a good many matters of interest. The year's working resulted in a gross profit of £140,771, from which interest and sinking fund absorbed £91,056, leaving a balance of £49,715 on the year—some £2,000 less than in the preceding 12 months. The balance was applied to depreciation, which was written off capital account to the extent of £53,259, thus leaving a deficit of £3,544, which was made up from the reserve fund. The latter fund now stands at £19,281. While reduced charges, metal lamps and bad trade caused the revenue to fall some £8,000, as compared with 1907-8, this was more than counter-balanced by a saving on working expenses of £10,415. The deficit is accounted for by an extra £4,000 to sinking fund, and £3,108 for depreciation, as compared with the previous year. The taxation of the undertaking for the year amounted to £18,745. Some 32,736,058 units were sold, including 17,612,483 units for power purposes. In connection with the latter, 4,292 motors, with a total horse-power of 29,505 were connected, and of the power units sold, 4,716,263 were sold at 1½d. per unit, 980,996 at 1d., and 11,915,224 at ¾d. per unit. The bulk of the lighting units (8,192,411) were sold at 3½d. per unit. Some 837 arc lamps were in use for street lighting, and there were 18,158 consumers at May 31st, 1909.

Turning to the power plant, &c., the report states that the maximum load amounted to 21,585 KW., being a decrease of 2·7 per cent. on the previous year. Generation, distribution, and management costs amounted to ·56d. per unit; rent, rates, taxes, interest, and sinking fund brought the total statutory expenditure to 1·36d. per unit, against which the gross receipts amounted to 1·7d per unit.

During the year the Port Dundas station generated 29,595,529 units; Pollokshaws Road, 11,322,201 units; and Kelvinside, 575,303 units. At the Port Dundas station, marine water-tube boilers, &c., and coaling plant were brought into use, also a fifth turbine set of 5,500 H.P., making a total of 28,000 H.P. installed. At the Pollokshaws Road station, additional boilers were erected, and a third 5,500 H.P. turbine set, making 21,700 H.P. installed. No additional transforming plant was added to existing sub-stations, but a new sub-station at Haggs Road was brought into use, containing 1,000 KW. of plant. Six large consumers have some 3,000 H.P. of transforming plant on their own premises. Ten miles of feeders and six of distributors were laid on the north side of the river, and five miles of feeders and four of distributors on the south side, during the year.

At a recent meeting of the Electricity Committee, the engineer (Mr. Lackie) explained that the reduction of £495 13s. 6d. effected in the cost of attending to and repairing public lamps last year, was mainly due to improved switching apparatus invented and patented by two of his assistants (Mr. W. T. Calderwood and Mr. H. MacEwen) and himself, and the Sub-committee, after consideration, agreed, in respect that the Corporation is exempt from any royalty on the apparatus used by it, to recommend that an honorarium of 100 guineas be granted to meet expenses already incurred in patenting the apparatus, the sum to be divided between Mr. Calderwood and Mr. MacEwen.

The Territorial Force of the city has asked the Electricity Committee for a reduction in the price of the electricity supplied for lighting purposes, and the Committee has instructed the engineer to advice the Association with the view of reducing its account for current by improved methods of lighting. No reduction in price per unit has been made.

Gravesend.—The T.C. has received from the L.G.B. sanction to loans of £3,250 in respect of excess expenditure, £1,800 for mains, and £700 for services.

Greenock.—It is reported that the accounts of the T.C.'s electricity department for the past year show a surplus of £1,035. In accordance with the recommendation of the Scottish Office, it was decided to make this sum the nucleus for a reserve fund.

Haslingden.—The B. of G. has appointed Messrs. Peers, Copland & Cardin to prepare a scheme for electric wiring at the workhouse and new infirmary to utilise the supply by the Rawtenstall Corporation—their remuneration to be an inclusive fee of 50 guineas, such amount to include preparation of the scheme and supervision of the same, travelling expenses and plans, &c.

Ipswich.—The T.C. has arranged to supply current for seven years to the Admiralty telegraph station at Portman's Walk at 1½d. per unit. The consumption will be about 40,000 units per annum, and the Admiralty will pay the entire cost of the surface cables, and £5 10s. per annum for maintenance.

Kearsley (Lancs.).—The B. of T. has approved of the transfer of the U.D. Co.'s electric lighting order to the Lancs. Electric Power Co.

Morecambe.—The T.C. has decided to ask Mr. W. R. Wright, electrical engineer, London, to report on the condition of the electricity works. The outlook is brightened by the application for a supply from the New Morecambe Tower and Gardens Co.

Northampton.—The Governors of the General Infirmary have decided to have the new laundry driven by electricity. This will save £750 on capital expenditure, and £90 per annum on the coal bill.

Partick.—The T.C. is to make extensions and additions to the plant at the electricity works, including the supply and erection of a 1,000-KW. set, together with a condensing plant, cooling tower, and oil purifying plant, water-tube boiler, &c. The sum of £13,472 will be borrowed for electric lighting purposes.

Perth.—Councillor Macnab, Convener of the Electricity Committee, states that last year's revenue, exclusive of the tramways, was £7,990 or more than double the first year's revenue (1901-2). The estimated expenditure of £4 544 was £402 less than anticipated. As to the current year's estimates, he estimated the revenue at £8,110. Having regard to the annual increase in the use of electricity, he believed the estimate erred on the safe side, and would be more than realised. That there would be some increased expenditure there appeared not to be much doubt. The cost of the maintenance of the accumulators under a new contract had to be met for the first time.

The Corporation has fixed the price of electricity at 3¾d. per unit, the same as last year.

Rossall.—The governing body of the Rossall School (Lancs.) are carrying out extensive improvements involving a large expenditure, and including the installation of electricity for lighting and power purposes, and a very complete plant for heating, ventilating, and hot and cold baths.

South Africa.—It is stated that the Germiston T.C. has entered into a three years' contract with the Victoria Falls and Transvaal Power Co. for a supply of electricity for lighting and tramways purposes. The Council has engaged Prof. J. H. Dobson, manager of the Johannesburg lighting and tramways department, to report on suitable schemes.

Swinton and Pendlebury.—The U.D.C. has requested the Lancs. Electric Power Co. to continue the management of the E.L. undertaking for a further three months, pending consideration of the appointment of a manager by the Council.

U.S.A.—Some interesting statistics relating to the Chicago Commonwealth Edison Co.'s distribution were recently given by Mr. D. W. Roper, from which it appears that in Chicago the output of 25-cycle energy has increased 17,000 KW. per year during the last five years, while the use of direct current only increased at the rate of 3,000 KW. a year. The average length of the direct-current feeders is 1,500 ft., and three-fourths of the copper used is in feeders and one-fourth in consumers' services. Last year the maximum load on the generating stations in 25-cycle energy was 107,000 KW. Of this, some 40,000 KW. in the centre of the city was furnished as direct current, 20,000 KW. being used in the business district—where the most congested part was a half-mile in States Street taking 5,000 KW. Overhead construction cost only ⅓ or ¼ of underground work in residential districts, though the maintenance was approximately the same for both. For each lb. of copper installed for all purposes during five years, 1 duct. ft. of conduit was laid; the conduit costing 15 to 60 cents per duct. ft. The company has some 300 miles of transmission lines, &c., and burn-outs average one a month.

Widnes.—Following upon the town clerk's interview with a representative of the B. of T. relative to the carrying out of the E.L. order, 1901, the T.C. has decided that the advice of a qualified electrical engineer be obtained upon the scheme suggested by Mr. Isaac Carr, C.E., for carrying out the order.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The revenue from passenger traffic on the Corporation cars last year was £70,735, a decrease of £429 over the previous year. The total working expenses amounted to £40,794. The cost of electricity for power, increased from £8,971 in the previous year, to £9,564.

Bolton.—The Tramways Committee, after lengthy deliberation, has decided not to issue contract tickets on the tramways.

Colwyn Bay.—Public pressure has compelled the U.D.C. to urge the tramway company, who work the electric tramway system connecting Colwyn Bay with Llandudno, to extend its line from the existing terminus at Station Road, Colwyn Bay, to the far end of Old Colwyn. The projected extension will add 1½ miles of track to the existing route, and open out a populous and promising area.

Doncaster.—The T.C. has decided to extend the tramways to the new colliery at Bentley. The colliery company will give the Council facilities for laying the lines, and will contribute £100 a year for two years towards the cost.

Germany.—The Rhenische-Westfalische Electricitatswerke is preparing plans in respect of a projected electric tramway between Opladen and Langenfeld.

Leeds.—The T.C. has a proposal in hand to install the trackless trolley system from the Oldfield Lane tram terminus through the district to Lawns Lane near the Farnley Ironworks. The distance is about a mile. In order to receive the consideration of Parliament next session, the Leeds Corporation must lodge its Bill not later than November. No suggestion has been made that the Leeds Bill should contain any request for powers to carry parcels.

(*Continued on page* 303.)

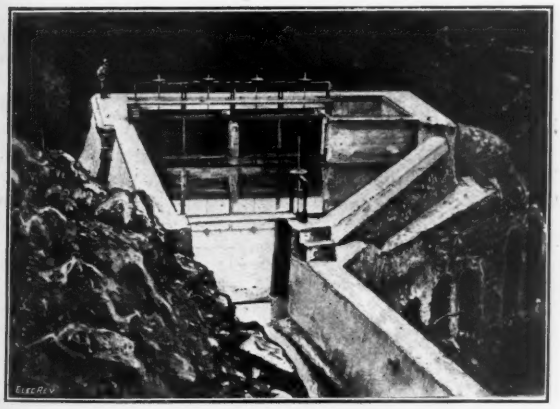
A SPANISH POWER-TRANSMISSION PLANT USING 50,000 VOLTS.

By Dr. ALFRED GRADENWITZ.

The power-transmission plant recently installed between Gaucin and Seville, in Spain, is specially interesting because of the pressure (52,000 volts) and the distance to which the electrical energy is transmitted (125 km.).

Power is derived from a waterfall on the river Guadiaro, situated between Gaucin and San Pablo, in the province of Malaga, the gross head being 137 metres and the net head 128·5 metres. The minimum amount permanently available is 1,500 litres per second, but there is available during eight months in the year 4,000 litres. The water is held up by an embankment 25 m. in length, from which a channel 5·7 km. in length (of which 1·1 km. is in tunnel) connects to a water compartment, designed for three penstocks, and 25 m. in length; the capacity of the water compartment is 360 cb. m., and the overflow embankment is 16 m. in length.

Two pressure conduits, each 1 m. in diameter and 500 m. in length, carry the water to the power house; 200 m. of their length is of armoured concrete (up to 50 m. pressure), while the remaining 300 m. is made up of pipes, 6 m. in length, of Siemens-Martins steel with Bessemer steel flanges tightened by means of caoutchouc.

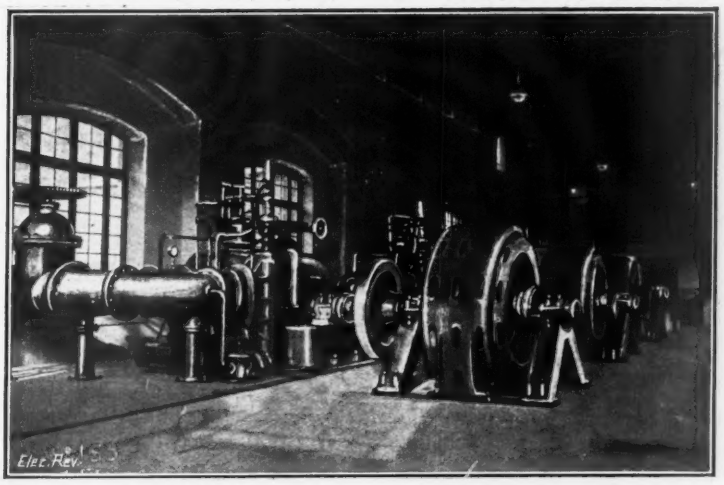


The Penstocks and Head Works.

Three Pelton wheels, of 1,500-H.P. capacity each, have been installed. These are of the horizontal-shaft type, with cast-steel vanes, and are arranged for automatic and hand regulation, and provided with oil governors. Each of them drives a 1,300-K.V.A. three-phase generator running at 410 R.P.M.; two similar units of 100 H.P. each have been provided to operate the continuous-current dynamos supplying the excitation and lighting current.

In addition to the power station, four sub-stations are provided, from which secondary lines for power transmission and lighting are branched off.

The three-phase current is generated at 40 cycles per second and 5,000 volts pressure, which latter is stepped up by transformers to 52,000 volts for the transmission of power to Seville.

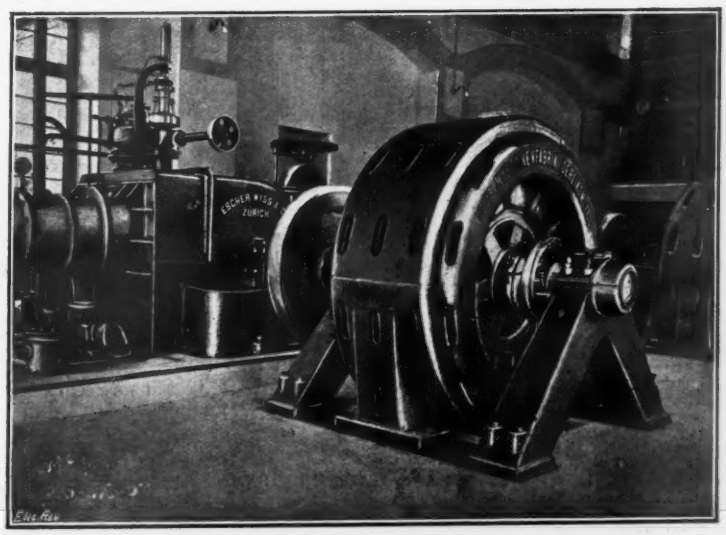


Interior of the "El Corchado" Power Station.

Although the power house is designed for 4 units of 1,500 H.P. each, only three have been so far installed. The generators are of the rotating-field type, and are controlled by oil switchgear with maximum-time relays and reverse-current relays.

Either of the two direct-current generators suffices for the excitation of the four main generators. The direct-current machines are each of 65 KW. output at 110 volts and 1,000 R.P.M.

Seven single-phase transformers are provided (of which one serves as stand-by), and these are constructed for oil and water-cooling and controlled by oil-break switches, provided with maximum-time relays in the low tension, and with maximum and reverse-current relays in the high-tension circuits, the two switches being coupled together electrically. The low-tension switches are provided with mechanical and the high-tension switches with electrical remote-control. Each transformer is of 600 K.V.A. capacity, with a step-up ratio of 5,000/50,000. The reserve transformer can be connected up to any phase desired.

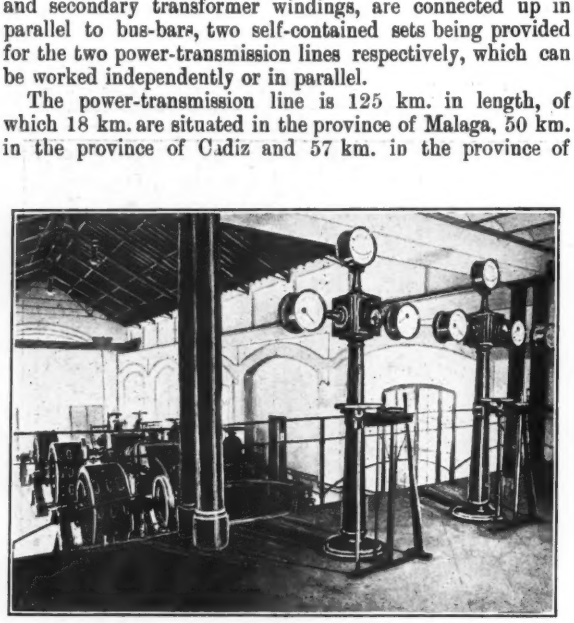


1,300-K.V.A. Pelton Wheel and Generator.

The two overhead lines, starting from the power house, for the transmission of energy, are provided with lightning arresters connected to the ground through water resistances.

At the switchboard the generators, as well as the primary and secondary transformer windings, are connected up in parallel to bus-bars, two self-contained sets being provided for the two power-transmission lines respectively, which can be worked independently or in parallel.

The power-transmission line is 125 km. in length, of which 18 km. are situated in the province of Malaga, 50 km. in the province of Cadiz and 57 km. in the province of Seville. The maximum altitude (770 m. above the level of the sea) is attained between the Atlantic and the Mediterranean in the environs of Mount Berrueco, and the minimum altitude (11 m.) near the river Guadaira at Seville. The majority of the 1,550 poles constituting the line are built of U-shaped irons with iron-bracket diagonals and wooden cross beams. The average distance between poles is 80 m., but spans of 100 to 120 m. are by no means infrequent, and at certain places even 200, 300 and 450 m. spans are reached.



Switch Pillars in the Power Station.

The power-transmission line consists of two sets of three wires, each of 5·5 mm. diameter. Double wires are adopted in the case of spans upwards of 90 m., and with spans exceeding 200 m. the wires are suspended from iron cables. The wires are spaced 1 m. apart.

The power-transmission line comprises 35 wire crossings.

Of the sub-stations, that at Villamartin, situated at 55 km. from the power house, has two incoming and two outgoing lines, connected together inside the station. Horn lightning arresters (with liquid grounding resistances) and 50,000-volt oil-switches, one being set apart for each line and the mutual connection of lines respectively, are provided, the apparatus being mounted in armoured-concrete cells.

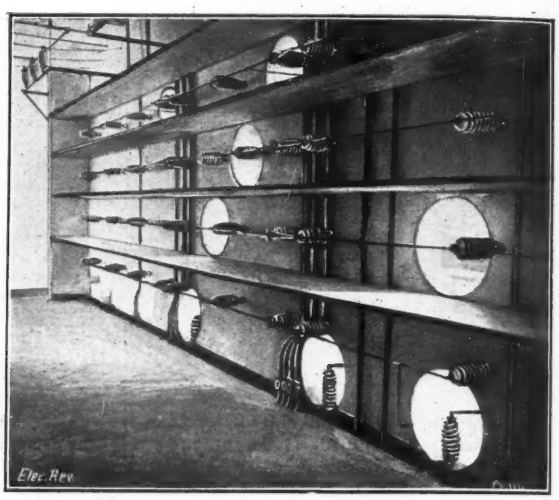
The Utrera sub-station, situated 94 km. from the power house, is similar in arrangement to the foregoing. The lines are protected by horn lightning arresters with liquid resistances and water-jet resistances, permanently connected to the ground.

Six mechanically-controlled line oil-switches for 50,000 volts are installed; also four single-phase transformers, water-cooled, one being a reserve. The primary pressure is 47,000 volts, and the secondaries give 3,400, 3,500 and 3,600 volts respectively. The capacity of each transformer is 200 K.V.A.

The transformer circuits are controlled by oil-break switches, with time relays designed for mechanical remote control with electrical releasing.

A single conductor-system serves both for the light and power supply. Oil switches with time relays, as well as self-acting induction regulators, are provided in the outgoing lines, the apparatus being arranged in armoured-concrete cells.

The Dos Hermanas sub-station, situated at 112 km. from the power house, is arranged like that of Villamartin, but the oil switches are replaced by ordinary ones. It contains one three-phase water-cooled transformer, arranged for 47,000 volts primary, and 3,400, 3,500, 3,600 volts secondary pressures. Its capacity is 360 K.V.A.



Armoured-Concrete Cells and H.T. Bus-bars in Power Station.

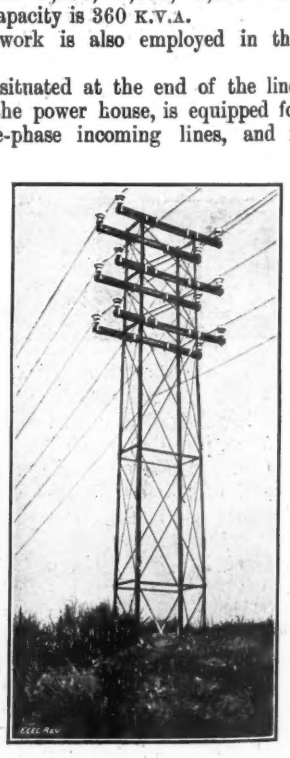
Armoured concrete cellwork is also employed in this building.

The Seville sub-station, situated at the end of the line, that is, at 125 km. from the power house, is equipped for controlling the two three-phase incoming lines, and is provided with the same type of switchgear as in the power house, by which the lines can be worked independently or in parallel.

One of the seven single-phase transformers serves as a reserve.

Each of the transformers is controlled by oil switches, coupled electrically to time relays in the primary circuits and to reverse-current relays in the low-tension circuits. The low-tension switches are designed for mechanical, and

Transformers in the Seville Sub-station.



Typical Transmission Pole.

the high-tension switches for electrical, remote control. The capacity of each transformer is 600 K.V.A., the primary pressure 47,000 volts, and the secondary 3,500 volts. The reserve transformer can be connected up to any phase desired.

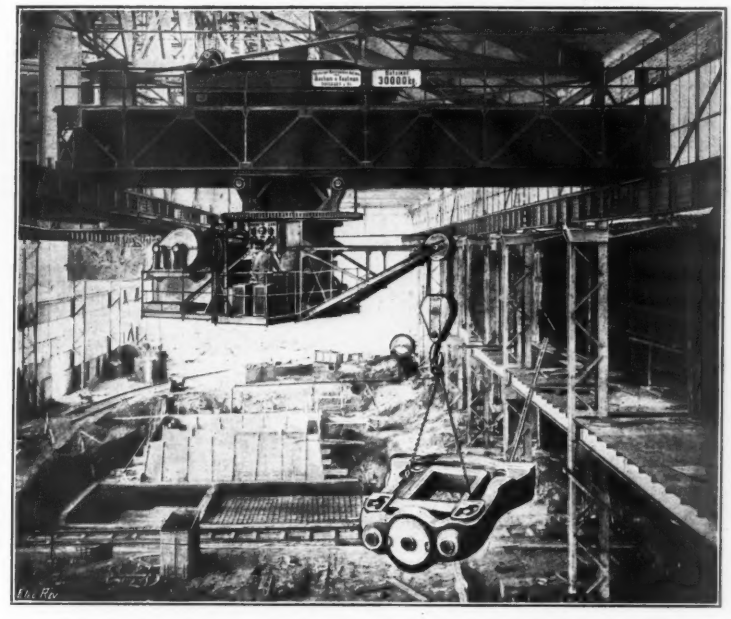
The switchgear is designed in duplicate, corresponding to the two lines; the apparatus is arranged in armoured-concrete cells. The switchboard contains ten panels for the secondary distribution lines, and one for the voltmeters, phase-lamps and meters. The measuring instruments and checking apparatus of the incoming lines and transformers are arranged on switching desks.

The secondary lines are branched off to loop bus-bars in two sets for the power and lighting, respectively, working either independently or in parallel.

The writer is indebted for the above particulars to the courtesy of the Oerlikon Machine Works, who constructed the whole of the plant.

TWO NOVEL ELECTRICAL CRANES.

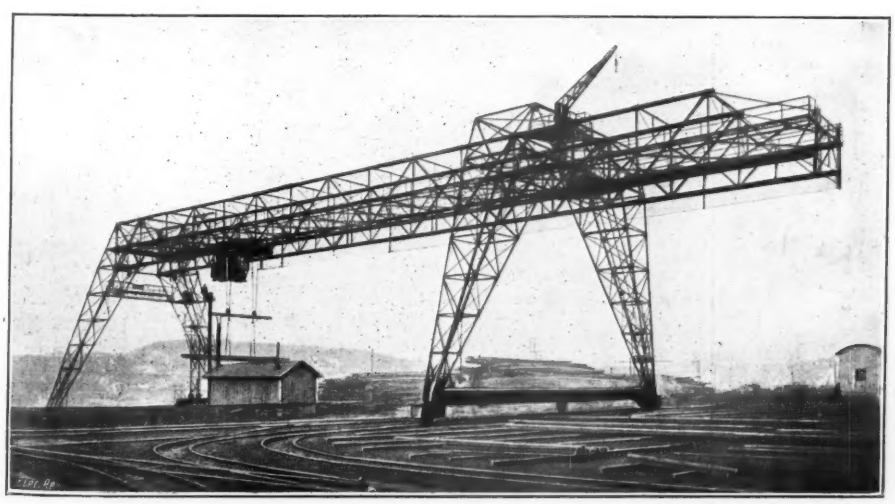
THE accompanying views illustrate two interesting types of cranes which have lately been provided by Messrs. Bechem and Keetman (Duisburger Maschinenbau A.G.) at important German iron and steel works. The first view shows one of four overhead travelling cranes which have been provided at Messrs. Thyssen & Co.'s works at Muhlheim-on-the-Ruhr. Each of these cranes is fitted with a revolving jib attached to the trolley, and has a span of 13·2 m., and a lifting capacity of 30 tons. The outreach of the revolving jib is 4 m., so that each of these cranes covers a working range of 17 m. wide. The crane bridge is composed of box girders with parallel chords, stiffened by platforms, whilst the trolley with the revolvable jib runs on the crane girder. The driving gearing of the trolley consists of spur wheel reduction gear; the movable jib is arranged on a ball-collar-thrust bearing, and is suspended from the trolley by means of a forged steel centre pivot. The design is such that at one end of this revolvable jib is the load hook, whilst at the other end, the counterweight and the driver's cab are attached, space for the driver being provided in such a way that the operator constantly has the load in view. The tilting moment of the crane is taken up by an upper collar-bearing and a lower roller-bearing at the end of the guiding structure suspended from the trolley. The revolving movement of the jib is effected by the teeth of a forged pinion meshing with the pins of a pin wheel rim fixed to the jib. The lifting gearing is situated at the after portion of the jib, and serves at the same time as a counterweight. Spur wheel reduction gears are provided throughout and braking is effected by means of an electromagnetic brake. The following are the motor capacities and the working speeds:—



ELECTRICAL TRAVELLER WITH REVOLVING JIB: CAPACITY 30 TONS.

Lifting, 2 2 m. per minute	...	22 H.P.
Traversing, 18 m. per minute	...	14·5 H.P.
Revolving, 1 m. per minute	...	14·5 H.P.
Travelling, 45 m. per minute	...	33 H.P.

The lower view shows a gantry crane of 5,000-kg. lifting capacity, provided at the Rochlingische Iron and Steel Works, situated at Volklingen-on-the-Saar. As may be seen from the illustration, one leg of this crane is equipped with a revolvable jib, which is operated by hand. The iron structures consist of lattice-work, and the trolley runs on the lower chords of the main girders. The distance between the supporting legs is 43·3 m., and the outreach of the jib is 13·7 m. The crane travels on eight wheels, arranged in pairs, and the pressure on the wheels is therefore well distributed. The two crane travelling-motors are connected by transmissions with a view to securing an even travel. Two wheels of each of the crane-legs are set in motion by means of spur gearing, and the shafting is provided with bearings, access to which is easily obtained by runways and convenient ladders.



YARD TRAVELLER AT A GERMAN STEEL WORKS.

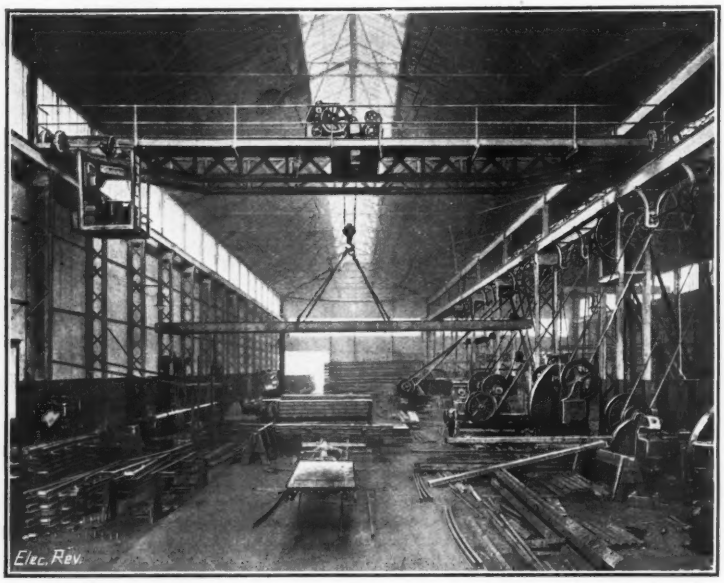
Boston Lighting.—Messrs. Crompton & Co., Ltd., have informed the T.C. that they intend applying for a provisional order for electric lighting.

ELECTRICAL CRANES AT KERR, STUART AND CO.'S LOCOMOTIVE WORKS.

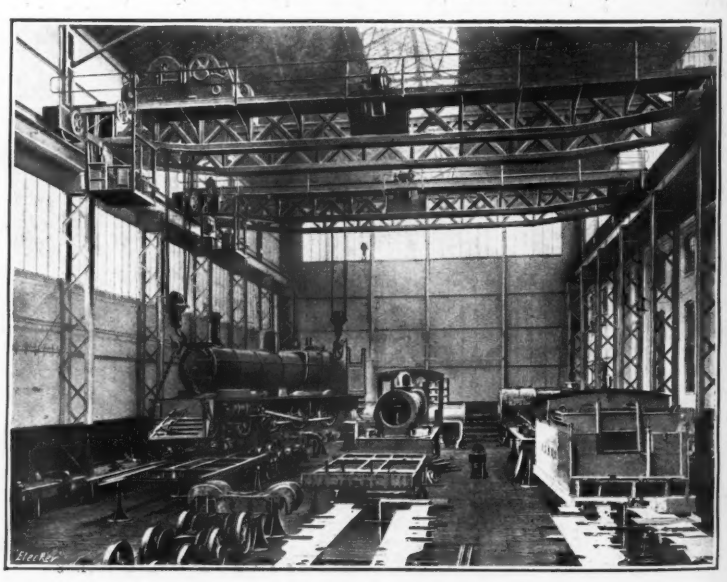
At their new workshops at Stoke-on-Trent, Messrs. Kerr, Stuart & Co., the well-known locomotive builders, have in service an installation of one 5-ton and two 30-ton electric overhead cranes, all three constructed by Messrs. Royce, of Trafford Park. The span of the 30-ton cranes is 53 ft. 5 in., and of the 5-ton crane, 47 ft. 6 in. All the cranes are of the three-motor type, a separate motor being used for each of the motions of hoisting, travelling and traversing; but in the case of the 30-ton cranes the hoisting motion is provided with a separate auxiliary barrel with rope and hook-block for dealing with loads up to 5 tons and lifting the same at a comparatively high speed. The two barrels are operated from one hoisting motor, and are brought into gear with it by means of clutches, fixed so that they can be operated by the driver from his cage when the crab is brought up to the cage end. When changing over from one barrel to another it is impossible for the hooks to run down, as small special brakes are provided to prevent this. The speeds for the 30-ton cranes are as follows:—

Hoisting (main barrel) full load	5 ft.	per minute.
Hoisting (main barrel) half full load ...	7½ ft.	"
Hoisting (main barrel) light load	10 ft.	"
Hoisting (light barrel) 5 tons	30 ft.	"
Hoisting (light barrel) light load	60 ft.	"

The travelling and traversing speeds are 150 ft. and 80 ft. per minute respectively. The various special features of the "Royce" cranes are provided, including riveted-up steel crab frame, machine-cut steel gearing, over-winding safeguard for the hoisting motion; automatic electrical solenoid brake for the hoisting motion, with hand-release device, which can be operated from the cage. Roller bearings are provided for the axles of the travelling and traversing motions; the travelling motion of each crane is also fitted with a powerful foot brake, as well as the "Royce" slipper-wheel device, which also can be used as a powerful brake for pulling the crane up quickly. The hoisting motion is fitted with the "Royce" standard dead-slow device, by which a constant dead-slow speed is obtainable for either lifting or lowering. This device is very simple, is entirely under the control of the driver, and for wheeling locomotives, or where loads have to be moved fractional and exact distances, it is of the highest importance. When in operation, the load is lifted or lowered with perfect steadiness, and without any tendency to vibration or jerkiness. One of the special advantages of the two 30-ton cranes is that an especially heavy load up to 60 tons can be dealt with if the cranes are brought together and the load slung between the two hooks. The 5-ton crane is also fitted with the "Royce" special features: the hoisting speed is the same as those for the 5-ton lift of the two 30-ton cranes; the travelling and traversing speeds are 250 ft. and 80 ft. per minute respectively. All parts of the cranes, both mechanical and electrical, are of Messrs. Royce's make throughout.

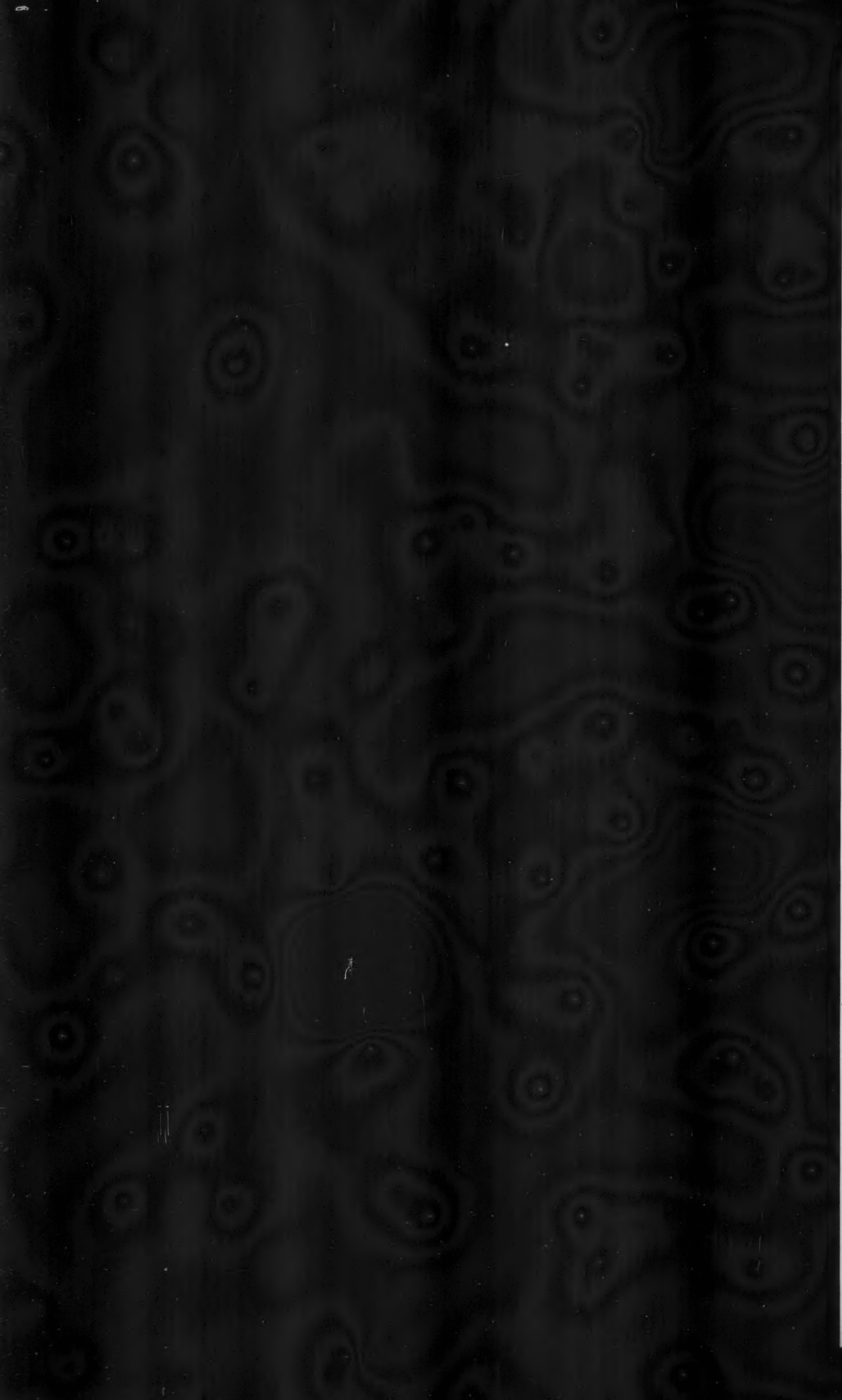


Royce 5-ton Electrical Travelling Crane; Kerr, Stuart & Co.'s Works.



Two 30-ton Royce Travelling Cranes; Kerr, Stuart & Co.'s Works.

Electrolytic Hydrogen for Balloons.—A very interesting plant for the production of hydrogen gas for balloon purposes by an electrolytic process has been installed at Fort Omaha, Neb. A balloon house has been erected at this fort for the experiments of the U.S. Army Signal Corps. Alongside this house is a building containing the hydrogen generating plant. Electrical energy for the operation of this plant is obtained from the Omaha Electric Light and Power Co. A 200-kw. motor-generator set has been installed, which consists of an induction motor direct-connected to a direct current generator wound to give a pressure of from 66 to 110 volts. The hydrogen is generated by electrolysis in cast-iron cells containing caustic potash electrolyte. There are 30 of these cast-iron electrolytic cells, all connected in series. The voltage required varies according to the temperature of the cells, hence the wide range of voltage for which the generator is designed. The operating pressure when the cells are warmed up is 85 volts for the 30 cells, or 2·8 volts per cell. The cells are rated at 1,500 amperes. The output of hydrogen at 1,500 amperes is about 23 cb. ft. of gas per hour, or 690 cb. ft. for the 30 cells. Both of the electrodes are of iron. The iron case of the cell forms the negative electrode from which the hydrogen is obtained. The positive electrode, which gives off oxygen, is in the shape of an iron cylinder in the cell. Hydrogen gas, which collects above the negative electrode, is piped to a 50,000 cb. ft. gas holder. The oxygen, which might easily be sold commercially to cover much of the cost of operating the plant, is allowed to escape into the air, because Congress has seen fit not to authorise the United States Army to sell this by-product.



TRAMWAY and RAILWAY NOTES.

(*Continued from page* 298.)

Glasgow.—The T.C. members and the public generally are expressing satisfaction at the decision of the House of Commons Select Committee on the Glasgow Bill, in regard to the placing of the surplus revenue from the tramways undertaking to the common good fund, the question of whether the tramways were part of the common good fund—which at times of extension helped with finance—was raised by the Scottish Office, where it was held that the tramways were not the common good property. The practice hitherto has been for the tramways department to hand over a fixed sum annually to the common good to wipe out its indebtedness. In 1895 a sum of £9,000 was given. This amount was gradually increased, and last year it rose to £50,000. The total sum handed over during 15 years, was £326,760. Now the whole surplus will go to the common good, and had this been in force last year, the sum transferred to that department would have been £66,275. The Scottish Office's principal contention was for a limitation of the annual amounts to be handed to the common good fund, and in his report on the question, the Secretary for Scotland (Lord Pentland), points out that having regard to the large amount of the profits, their disposal should not be left to the unfettered discretion of a Corporation.

Holywood.—Much pleasure is expressed locally at the Royal Assent having been given to the Holywood Tramways Bill, which has for its object the construction of a line between Holywood, Co. Down, and the city of Belfast. The line will help to bring the two places into contact, and improve the trade of both.

London.—According to the *Times*, the Central London Tube extension to Liverpool Street for which Parliamentary powers have recently been obtained, will be begun at once. The other improvements mentioned in the company's Bill are also to be carried out.

A considerable amount of discontent is said to exist among the L.C.C. tramways staff who are working the Streatham-Norbury extension, recently opened. The cause is said to be the transfer ticket system to the Croydon lines.

The Metropolitan Ambulances Bill came before the Grand Committee of the House of Commons on August 17th, when it was decided, by 28 votes to 1, that the L.C.C., and not the Metropolitan Asylums Board, should be the body to carry out the service. Subsection 7 of Clause 1 ran as follows:—"To provide and maintain ambulances and other vehicles, and means of conveyance, to be drawn by electrical or other mechanical power, by horse or by hand." Upon the motion of Sir William Collins, the following words were added:—"Provided that any electrical power used for moving such vehicle, shall be entirely contained in, and carried along with such vehicle."

Mexico.—There has recently been considerable activity in the building of inter-urban lines in Mexico, and it has been announced that an American syndicate is planning a new line from the city of Guaymas to the suburban towns of Aurora, San Jose, De Guaymas, and Empalme. This road will be about 16 miles long. There is also a Canadian syndicate in the field, and it is planning a line between Mexico City and Puebla. The proposed line runs between the two volcanoes, Popocatepetl and Ixtaccihuatl, and parts of it will lie above the winter snow line. Power for its operation will be obtained from the electric plant of the Mexican Light and Power Co. at Necaxa.—*Electric Traction Weekly.*

Newcastle-on-Tyne.—The report of the city engineer (Mr. C. R. S. Kirkpatrick) to the Tramways Committee, states:—The expenditure on the general maintenance of the tramway track for the year ended March 31st, 1909, was £7,313. The down track of Westgate Road was renewed at a cost of £494, and a new loop, forming a junction between Elswick and Westgate Roads, was constructed at a cost of £341. The total cost for renewals was £1,403, included in which was £50 for the construction of an additional 20 yards of track in Heaton Road. All the tramway rails in stock, after treatment with bitumastic solution, have been stacked under a shed at St. Peter's. The expenditure for this item was £1,007, including the cost of shed. The laying of the track in Market Street extension and the junction at Pilgrim Street were completed, and the expenditure for the year was £3,097. A vehicle fitted with carborundum blocks had been engaged at night grinding the rails to remove corrugations, and with satisfactory results. The cost had varied from 6d. to 1s. per lineal yard. It was found that immediately the corrugations were removed the maintenance on that section of the track was automatically reduced.

Perth.—There is a deficiency of £1,500 on the tramways for the past year. The fares yielded £200 less than the estimate, and the expenditure has been £100 more than expected.

South Lancashire.—We learn that the South Lancashire Tramways Co. is negotiating with the Worsley and Little Hulton District Councils with a view to securing powers to construct additional tramways in those townships. The lines already in operation from Farnworth through Walkden to Swinton are proving remunerative.

Taunton.—The Rowbarton extension of the Taunton tramways was inspected by the B. of T. on August 13th; the work has been carried out by Wm. Griffiths & Co., London.

U.S.A.—The first 1,200-volt direct-current electric railway system in New England is to be constructed between Presque Isle and Washburne, Me., with an ultimate extension of 110 miles to the St. John River, according to an announcement recently made. The Aroostook Valley Railroad, affiliated with the Canadian Pacific Railway, is the promoter. The new road will be built for both passenger and freight traffic. Power will be bought, according to the plans, from the Maine and New Brunswick Power Co. at Aroostook Falls. On the south, the new road will connect with the Canadian Pacific.—*Electric Traction Weekly.*

TELEGRAPH and TELEPHONE NOTES.

American Railway Methods.—The use of modern methods of handling telegraph business of railway companies is illustrated by the equipment of the general offices of the Santa Fé's coast line at Los Angeles. All departments are connected directly by pneumatic tubes with the telegraph office, 31 tubes being used for this purpose, states the *Telegraph Age*. The system handles between 50-60,000 messages and reports monthly, and is very successful, doing away with the congested filing of business which occurred under the old system of messenger delivery and collection, and also expediting the handling of messages.

Canadian Wireless Stations.—The United Wireless Co. has made an offer to purchase the Canadian Government's wireless stations on the Pacific Coast. The offer, the *Standard* says, is not likely to be accepted. The Dominion Government maintains a number of these stations in connection with the coast protection service, but has not as yet opened them to commercial business.

Jamaica Telephones.—The *Jamaica Guardian* states that the licence held by the Jamaica Telephone Co. has been extended by the Governor in Privy Council to April 30th, 1910. The licence for the Vandeville and Montego Bay telephone service has also been extended to the same date.

South Africa.—It is reported that the Transvaal Government has extensive improvements in hand with the telegraph and telephone services all over the colony, which will make it one of the best equipped in the world. It is suggested to link up every town, and main trunk lines are to be carried to every point where the railway lines cross the border, with a view to their ultimate extension to the coast ports when the other colonies are ready. It is regarded as certain that the Union Government will find telephonic communication between Cape Town and Pretoria absolutely essential. The scheme contemplates connections with farmhouses as well as the establishment of call offices at convenient centres. It is estimated that the coast extensions will cost £250,000. A concentrator has already been installed in Johannesburg to enable messages between minor offices to pass direct to their destination, without any necessity for taking off and retransmission at central stations as heretofore.

Telegraphic Interruptions and Repairs:—

	Interrupted.	Repaired.
Tangier-Cadiz	May 19, 1909	
Assab-Perim	July 8, 1909	
Trinidad-Demerara	Aug. 6, 1909	Aug. 13, 1909
Dakar-Conakry	Aug. 6, 1909	Aug. 14, 1909
Gibraltar-Tangier	Aug. 6, 1909	
Cuata-Tangier	Aug. 7, 1909	
Melilla-Chafarinas	Aug. 7, 1909	
Corfu-Trieste	Aug. 16, 1909	

The Eiffel Tower Wireless Station.—According to the *Daily Telegraph*, this station will be re-equipped by the end of next month, and will then be used for regular transmission to the United States and Canada. Wireless messages from New York are now received or intercepted almost daily, and occasionally Canadian messages are received.

The Madrid-Paris Telephone.—Negotiations for a through telephone communication between Madrid and Paris are well advanced, and telephone lines have been definitely arranged for between Madrid and Bordeaux.

The Telephonograph.—According to a daily paper, a Signor Pasquale, of the Italian Taranto Agricultural Bank, has invented a device bearing the above title, with the object of obtaining permanent records of telephone conversations, much in the same way as gramaphone messages are recorded. For business purposes such messages could be reproduced if desired.

Trinidad Telephones.—The *Trinidad Mirror* of the 21st ult. contains a leader on the subject of the telephone service in the island provided by the Trinidad Consolidated Telephones, Ltd., formerly the Trinidad Commercial Telephone Co., Ltd., which has issued a circular in which it states that the same rates will be charged as heretofore, although Trinidadians had hopes of their being reduced. The payment-in-advance system is strongly objected to because of the importance of obtaining service before paying for it. In conclusion, the *Mirror* hopes that wireless telephony will at some future date assist them in obtaining a reduction of rates.

Wireless Telegraphy in the West Indies.—The *Demerara Argosy* states that experiments at the West India and Panama Telegraph Co.'s station have been steadily proceeding towards the proper attunement of the apparatus for communication. Up to the present, however, though the stations at British Guiana and Trinidad have been in speaking touch all the time, and messages have been exchanged, the correct pitch has yet to be attained. Atmospheric influences, principally lightning, have unfortunately been hampering the work a good deal.

The Newfoundland Cable Dispute.—The full text of the letter addressed to the Newfoundland Government by the Commercial Cable Co. came to hand last week too late for detailed attention. The company states that it has invested over a million dollars on the faith of the contract of February 18th, 1909, which did not contain any provision requiring the approval of the Legislature. The contract required the company to pay the Government $4,000 annually as a tax on the cable, and an equal tax on the second cable which the company intended (and still intends, if the contract is observed) to lay. On the other hand, the Government is to pay $4,000 a year to the company as compensation to the latter for extending its cable from the landing place to the City of St. Johns, and maintaining a profitless office there, free of cost to the Government. The contract provided also that supplies should be free of import duties, a usual provision, but this clause was violated, the company being charged $4,322.60 duty on electrical apparatus.

The advantages to the Newfoundland Government were that the cable messages collected by the Government on its landline system could be handed to the company instead of traversing the whole length of the island and the Government's submarine cable to Nova Scotia, while the Government cost nothing in revenue, and the speed of transmission was increased. Lastly, considerable trade would have been brought to the island, especially if the company's cable steamer *Mackay-Bennett* was stationed at St. Johns, involving an expenditure of over $50,000 a year. The Government itself had asked the company to provide the direct cable connection, but now repudiated the contract, and thus, no doubt, pleased the Anglo-American Co., which was in competition with both the Government and the Commercial Co. The letter concludes with a protest against the repudiation of a solemn contract—an act hitherto unknown in the history of the British Government or its dependencies—and a denial of the Government's right to repudiate it.

The other side of the question is voiced by Sir Edward Morris, the Premier, who is now in London, and emphatically denies that there has been any breach of faith on the part of his Government, or that it fails to recognise the contract made with its predecessors or is hindering the laying of the company's cable. Sir Edward goes on to say in regard to his Government:—"It did, however, refuse, without ample consideration, to bring before the Legislature for ratification this contract of 1909, principally for the reason that it was unfair and prejudicial in many respects to the Anglo-American Telegraph Co., Ltd., which is a cable company, and would create in favour of the Commercial Cable Co. a monopoly for 25 years of the transmission of all cable messages passing over the Newfoundland Government landlines. The Commercial Cable Co., under its agreement made in 1905 with the Newfoundland Government, are now bringing in their cables. There is no objection to this, as the Government, only a few weeks ago, gave them the land they require, but the Government have not felt justified (not, however, without fully considering the matter) in granting by Act of Parliament the further concession attempted to be given in the agreement of 1909, namely, a monopoly for 25 years and freedom from taxation, whilst taxing the Anglo-American Co. doing business on the same street $20,000 per annum." . . . "The present Newfoundland Government, who were only in office a few days when this legislation was asked for, were fully justified in taking time to consider the matter before embarking on legislation." . . . .

In a letter to the Secretary of State for the Colonies, under date July 8th, Mr. F. A. Bevan, Chairman of the Anglo-American Telegraph Co., gave his company's views on the matter. This letter states that by the agreement of February 10th, 1909:—"Clause 2 extends the period of the Commercial Cable Co.'s 1905 agreement to 25 years from February 18th, 1909, and, together with Clause 3, confirms in specific terms the monopoly during that period to the Commercial Cable Co. (which is an American company) of all traffic from which the Government landlines, to the exclusion of my company (which is a British company), and whose landlines are also excluded from all business passing over the Commercial Co.'s cable. . . . . ." The letter also shows that under Clause 4 the Government is to pay the Commercial Co. $4,000 per annum "in consideration of the advantages and facilities secured" by the cable extension to Newfoundland and New York; but, the letter points out, the Anglo-American Co. has already four cables to Europe and five to the U.S., which are available for the Government. Moreover, the effect of the above subsidy is to remit to the Commercial Co. the landing tax of $4,000 per annum, imposed by law, on each cable between the Colony and any place outside; the Anglo-American Co. pays taxes on five cables amounting to $20,000 per year.

United States Telegraph and Telephone Statistics.—The third set of statistics recently published deals with the year 1907. Among other things, attention is drawn to the enormous single-wire mileage of commercial telephone and telegraph systems, the large growth of the telephone, as compared with the telegraph mileage, and the difficulties in wireless development. Tabular statistics are given showing that there were 1,813 telegraph systems, of which 25 were commercial landline and ocean cable, six wireless, and 625 railroad telegraph systems. There was a grand total of 15,072,220 miles of single wire in use by the telegraphs and telephones: of this, the telephone systems controlled 12,999,369 miles, and the telegraph systems, exclusive of Government telegraph systems, used 2,072,851 miles. Operating the telegraph and telephone systems, but exclusive of railroads and wireless, there were 22,996 companies, 22,971 being telephone companies. The ocean cable amounted to 46,301 nautical miles, all controlled by the commercial telegraph systems. The capital stock and bonds outstanding, par value, was $1,034,909,579, of which $814,616,004 was credited to the telephone systems. The total income was $236,045,615, of which the telephone concerns earned $184,461,747, expending $140,802,305; and the telegraph systems earned $51,583,863, expending $41,879,613. Of the whole number of systems in operation, the telephone formed 99·9 per cent.

The difficulty in obtaining separate statistics regarding land and ocean telegraph systems is mentioned; the last census shows that these systems dealt with 103,794,076 messages, which included 5,869,317 cable messages, and 29,110 telegraph offices were in use. Of the 25 telegraph companies, 24 were incorporated; only 11 paid dividends on their capital stock, being the same as in 1902. There were six commercial wireless telegraph systems, having 122 tower stations (in 1907), and these dealt with 163,617 messages. The capital involved was $39,450,000; the year's income, $122,154; and expenses, $169,782.

The Federal Government had installed wireless plant on 73 naval vessels, and in 44 shore stations. The shore stations (which are open to the public) sent 26 933, and received 34,073 messages. The U.S. railroads operated 807,824 miles of telegraph, and 52,518 miles of telephone wire, requiring 33,441 telegraph offices, and 30,115 telephones. These transmitted 5,923,483 commercial messages, and 258,589,333 messages on railroad business. It is inferred that the telephone will come into greater use for railroad work on account of its speed and flexibility.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—2,550 common battery telephones and protectors for the P.M.G. See "Official Notices" to-day.

Ballinasloe.—September 10th. The Committee of Management of the Ballinasloe District Lunatic Asylum wants tenders for the supply and erection of overhead cables. See "Official Notices" July 30th.

Burnley.—The Guardians have decided to obtain tenders for the electrical work required for the new nurses' home, and alterations at the Infirmary.

Edinburgh.—September 4th. The Corporation invites tenders for a motor-alternator and for an electric lighting installation. See "Official Notices" August 6th.

September 4th. Electric light installation at the new slaughter-houses, Gorgie, for the Corporation. Specification (one guinea deposit) from Mr. F. A. Newington, electricity supply works, Dewar Place.

Germany.—The municipal authorities of Wegscheid, Bavaria, are about to invite tenders for the establishment of a central electric lighting station in the town.

Glasgow.—Electric lifts for new Mitchell Library Wm. B. Whitil, architect, 219, St. Vincent Street.

Electric power plant for the Shieldhall works of the southern district sewage scheme. The Engineer on Sewage Scheme Construction, City Chambers.

Handsworth.—August 30th. Steam coal for the electric generating station of the U.D.C. F. A. Nixon, electrical engineer.

Leeds.—September 7th. Paper-insulated cables for the E.L. Department. See "Official Notices" August 13th.

Leyton.—September 7th. Public lighting lanterns with clock switches for incandescent electric lamps, for the U.D.C. See "Official Notices" August 13th.

Leyton.—September 7th. Electric light wiring and fittings for the Public Offices; extension for the U.D.C. See "Official Notices" to-day.

London.—Battersea.—August 21st. The Council wants tenders for motors and controllers, D.C. flame and enclosed arc lamps, and motor and arc lamp installations. See "Official Notices" August 6th.

L.C.C.—September 14th. The L.C.C. wants tenders for the supply and laying of 6½ miles of 0·075 sq. in. three-core cable and 46 miles of single-core cable, telephone cables, &c.; the supply of 50 tramway feeder pillars; laying 16 miles of stoneware ducts; and the supply of 440,000 stoneware ducts. See "Official Notices" August 6th.

Poplar.—September 8th. Electrical supplies for a year for the B.G. G. H. Lough, Clerk, 45, Upper North Street, Poplar, E.

September 1st.—Miscellaneous stores and electrical accessories for the Metropolitan Asylums Board. See "Official Notices" to-day.

Plymouth.—September 2nd. Steam turbo-dynamo for the Corporation. See "Official Notices" August 13th.

Rhyl.—August 21st. The U.D.C. invites tenders for a 125-kw. Diesel set and a 50-kw. steam dynamo. See "Official Notices" August 6th.

West Ham.—September 2nd. Electrical fittings for a year, for the B.G. Thomas Smith, clerk, Union Road, Leytonstone, N.E.

Wishaw.—August 30th. Three-wire D.C. switchboard for the Craigneuk sub-station for the Electricity Department. See "Official Notices" August 13th.

York.—August 27th. The Corporation wants tenders for 18 double-deck electric tramcars and a watering car. See "Official Notices" July 30th.

CLOSED.

Gravesend.—The T.C. has accepted the tender of Mr. W. R. Wills for an automatic stoker for the electricity works, at £215.

Hereford.—The T.C. has accepted the tender of the Blasberg Engineering Co., of Manchester, for a water-cooling tower, at £270.

Liverpool.—Repeat orders for vertical Curtis turbines have been given by the Corporation to the British Thomson-Houston Co.

Wallasey.—The following tenders for tramway stores has been accepted by the U.D.C:—

British Griffin Co.—Chilled iron wheels.
J. Baker & Co.—Steel-tired wheels.
National Rail and Tramway Appliances Co.—Brake blocks.
Dick, Kerr, & Co.—Bearings, &c.
Cammell, Laird & Co.—Axles.

NOTES.

Condensing Water for Jet Condensers.—A correspondent writes as follows:—If the steam supplied to an engine be passed through a good separator it should enter the cylinder practically dry. The only heat lost by the steam in its passage through the engine is that lost by radiation and that converted into work. That converted into work can be very closely calculated from the value $J = 778$ ft. lb. Under these circumstances the chemical method described at page 235 appears somewhat supererogatory. The heat content of a pound of steam at initial pressure is known, and so is that of the exhaust steam at the final pressure. Then neglecting radiation, the initial heat less the heat equivalent of the horse-power should measure the final heat. There is no need to take into account cylinder condensation, for this is purely a local action in the cylinder, and does not imply any disappearance of heat.

Excepting for heat converted into work any steam which enters a cylinder must leave it as steam, for the total heat per pound of initial steam is greater than in a pound of final steam, and the final steam would be superheated were it not for the wetness due to performance of work. The wetness overcomes the superheat.

Between steam at 180 lb. absolute and exhaust steam at 3 lb. absolute there is a difference of 70 thermal units, or 1 in about 17, or say 6 per cent. The difference should fully counterbalance the radiation loss, and leave only the wetness due to work done. The final steam may thus be assumed to contain 1,100 units above an ordinary injection temperature, as per steam table, which shows 1,125·1 total heat above 32° for steam at 3 lb. absolute. If the injection is discharged at 100° F., and has gained, say, 40° F., the steam has lost 1,060 heat units. Then each pound of steam has heated up $\frac{1060}{40} = 26\frac{1}{2}$ lb. of water, and the ratio of steam to water is 10 : 265. This seems a method quite sufficiently accurate for all practical purposes. It is open to such slight correction as may be made by anyone who wishes to recognise the fact that 1° F. in a pound of water is only equivalent to the thermal unit at one temperature, but this correction is hardly necessary.

The method of Mr. Empson, as given in the ELECTRICAL REVIEW of August 6th, is correct, but it does not distinguish between the steam discharged from the engine and the water that has passed through as priming, and so does not appear to avoid the inaccuracy pointed out in Mr. Empson's first paragraph. If any water has got by the separator, it will dilute the air-pump discharge, and will appear as steam in the calculation. Is there any necessity for such extreme accuracy in any case? If the hot well is too hot, would not more water be used, irrespective of the calculation? "Sure," said the Irish nurse, "I don't need this (a thermometer). If the baby comes out red, the wather's too hot, and if he comes out blue, its too cold!"

The Norwegian Nitrogen Industry.—At the new works at Notodden, for the extraction of nitrogen from the air by means of the Birkeland-Eyde electrical process, which have been in full work for more than a year, nitrogen is now oxidised in 36 furnaces, requiring 1,000 E.H.P. each. The products obtained are nitric acid, which in concentrated form is brought into the market in iron casks; calcareous nitre with 13 per cent. of nitrogen; and sodium nitrite, of which there was sold to German dye manufacturers during the last year a quantity, amounting to the value of about 1 million kroner (£55,555), and corresponding to one-third of the world's requirements. Apart from the above products, it is intended to produce ammonium-nitrate in a factory, which is to be erected specially for this purpose. By co-operation with the Badische-Anilin and Soda Fabrikgesellschaft, the original company has succeeded in procuring the necessary capital for the purchase and harnessing of the Rjukan Waterfall and others.

Two separate companies have been formed, one under the name of the Norwegian Power Co., with a capital of 16 million kroner (£888,889), and the other with the style of the Norwegian Saltpetre Works, with a capital of 18 million kroner (£1,000,000); a third company has also been formed, dealing only with transport, and having a capital of 3 million kroner (£166,667). The total capital which up to the present time has been spent at the Notodden, Svälgfoss and Rjukan waterfalls already exceeds 22 million kroner (£1,222,222), which, according to the estimates, will have to be increased to 54 million kroner (£3,000,000), when all the projected arrangements have been completed in about 10 years' time. Nothwithstanding many difficulties and mishaps, which occurred during the first year, the value of the products amounted to 2 million kroner (£111,111), and the net profits to 25 per cent.

Institution Notes.—MINING INSTITUTE OF SCOTLAND.—The members of this Institute, numbering 300, visited the collieries of the Lochgelly Iron and Coal Co., Ltd., on Saturday, to inspect the electrical power generation and distribution system there. The Lochgelly Co, who own pits covering a coalfield fully 16 square miles in extent, have one of the most modern electrical systems in the country, and a recent extension places it far ahead of any in the district. Until the end of last year the company provided power and lighting for their various pits by means of numerous isolated continuous-current plants of low and medium pressure, but, deciding some time ago to generate in bulk at high pressure at a convenient centre and distribute to the different pits from there, plant has been obtained sufficient meanwhile to supply five of the pits and the workshops on these lines, and the scheme is so designed that the remaining pits, seven in number, will ultimately be included. The power is transmitted from the central power house by overhead lines to the distant pits by high-pressure three-phase current. The power station contains four Babcock & Wilcox boilers in two batteries, each boiler having 2,531 sq. ft. of heating surface. There are two Belliss & Morcom self-lubricating three-crank triple-expansion engines, direct coupled to two Bruce Peebles three-phase 50-period alternators, having exciters on the same shaft. Each set is designed for a continuous output of 420 KW. on a 0·8 power factor (and for 25 per cent. overload for periods of 2 hours at clear intervals of 6 hours) at 3,000 to 3,300 volts when running at 375 R.P.M. The transformer stations are each designed to contain two 200 KW. transformers. To redeem the capital in 20 years the company hope to be able to deliver electrical energy to any pit in the coalfield for rather less than 0·3d. per Board of Trade unit, and with an increased load the cost may be even cheaper, owing to much of the capital expenditure already incurred belonging to possible, and, indeed, probable extensions. After the inspection the members were entertained to lunch, when Mr. George Mitchell, one of the directors of the company, expressed the pleasure that it had given him to welcome them on behalf of the Lochgelly Coal and Iron Co. He hoped that the day of jealousy amongst coal-owners was past, and that, in view of the competition which had to be faced at home and abroad, anything that was good for them in the way of cheapening production, was also good for them to learn and teach. Mr. McLaren, H.M. Inspector of Mines, in thanking the company for their courtesy and hospitality, stated that, in his opinion, neither money nor brains had been spared to make the Lochgelly pits the first in Fife. He hoped that if any of the members had any old installation at any of their mines they would get rid of it at once, and install something like that at Lochgelly. Messrs. Sayers & Caldwell, of Glasgow, were the engineers for the work.

Legal.—POSTMASTER-GENERAL *v.* RUSSELL.—In the City of London Court, before Judge Lumley Smith, K.C., on Tuesday last week, the Postmaster-General sued Mr. W. H. Russell, nurseryman, Haverstock Hill, to recover 15s. 7d. for the rent of an extension telephone line. The defendant had several other lines, about which there was no dispute. According to the report in the *Standard*, the defendant's manager said that the extension line was absolutely useless from beginning to end. They never could get connected, although he tried to do so over 50 times. At last they asked the Postmaster-General to take the machine away, and wrote and said that no sensible man would ask them to pay rent for the extension. Mr. W. Bregnall, for Sir Robert Hunter, the solicitor to the Post Office, said that the extension worked all right at first, but there was no responsibility on the Postmaster-General to maintain it, or to keep it efficient. If there was any error or fault on the part of the engineers, the Crown were not responsible, as they were not liable for the faults of any of their servants. Judge Lumley Smith said that the contract was a very tight one, and he had had similar complaints before. The defendant probably did not read the conditions under which he was bound. The fact that the extension was out of order was no answer to the present claim, and the contract precluded the defendant claiming damages. The defendant had trusted to the good feeling of the Postmaster-General that he would do his best to keep the extension in order. That was all. Judgment was given for the plaintiff, with costs.

Nalder Bros. & Thompson, Ltd., *v.* S. E. Smith.—At Lincoln County Court on Tuesday, plaintiffs sued Samuel E. Smith, electrician, Lincoln, for the return of two electrical instruments, or £5, their value and damages for detention. Mr. E. E. Payne, giving evidence for the plaintiff company, stated that the instruments were sent to A. C. Smith, Ltd., Lincoln, on loan for exhibition purposes in January, 1908. A great many were returned, but four, including the two electrical measuring instruments, were not. He saw the goods in defendant's premises on May 26th. Mr. J. G. Williams, who appeared for plaintiffs, said that they were only suing for two, because they could only prove that two were in defendant's possession. Sir G. S. Baker made an order for the instruments to be returned in a week, or, if not returned, a verdict for plaintiffs for £5. His Honour stated that he had a letter from the defendant asking that the case might be adjourned, as he had just received a telephonic message that his wife was seriously ill. On inquiry he was told that defendant had gone to Woodhall Spa.

Rossall School Installation.—The Governors of Rossall School have recently decided to make extensive alterations and improvements, including the installation of electricity. Messrs. Siemens are the main contractors, and are using their new Stannos wire throughout. A Belliss-Siemens steam dynamo is being provided, and the exhaust steam from this will be used in the calorifiers which are being installed to heat the school on the centralised hot-water system. A Westinghouse petrol set is also being put in. The whole installation is being designed and supervised by Messrs. Lacey, Sillar & Leigh, of Westminster and Manchester. The work will be completed before the boys return at the end of the summer holidays.

For Sale.—The Rhyl U.D.C. is offering for sale one 165-kw. d.c. steam dynamo. See our advertisement pages to-day for particulars.

We have received printed particulars of machinery, plant and tools, and other effects, of the Auto-Claw Co., Ltd., which are offered for sale by tender. They may be viewed on the premises, 148-150, Curtain Road, E.C., any day up to August 21st, between 10 a.m. and 1 p.m. Copies of the particulars can be obtained from Mr. James Todd, the receiver and manager, at 135, Wool Exchange, E.C.

Colliery Accidents.—It is reported that on Thursday, last week, two workmen, David Thomas (46) and Owen Davies (24), met their death at the Cribbwr Fawr Colliery, near Porthcawl. They were proceeding to their work, and when leaving the tram, they slipped, and, it is said, caught hold of an electric cable, from which they received a shock. One of them died instantaneously and the other a little later.

While working in Auchingiech Colliery, Chryston, on Sunday, James M'Mahon, a miner, met his death electrically. M'Mahon was engaged splicing a rope with the aid of a portable electric lamp. On taking the lamp from the hook, he received a slight shock, causing him to drop the lamp, which burst, and apparently thinking that the current was thus shut off, he stooped to lift the remains of the lamp, when he received the shock which killed him.

Up-to-date Bell-Ringing.—The offer of T. C. Keay, engineer, for the installation of electric power in connection with the ringing of the Old Steeple bell, has been accepted by the Dundee Town Council.

Appointments Vacant.—A salary of £104 yearly, with house, coals and light, is offered for an engineer to take charge of the installation at the large modern lunatic asylum at Bangour, near Edinburgh. Candidates must be experienced and fully qualified to take charge of the steam and electric plant.

Foreman of electric light service for Dominica, West Indies (£150). See our advertisement pages for particulars.

Mediterranean Push.—Messrs. Gent & Co., Ltd., send us the following letter, received by them from Malta, as the sequel to the amusing communication which was printed in our issue of July 16th, 1909, p. 102:—

"Mr. Gent and Co.,—

"It is not the first time we had business with many English firms under the conditions submitted to you or proposed by them, besides many others, as Germans, French and Italians, and always came to a conclusion.

"But, beg pardon, let us state that your well-known firm is one of those which we Maltese fellows since have been in the course of commerce never met across.

"Thanking you at last for the great trouble you had for publishing our letter in the Electrical Review.

"With many thanks, we remain,

"Mediterranean Push.

"N.B.—We beg this time to be kind again to publish our letter, and we will pay you for the expense."

Electrical Employers' Association of N.S.W.—According to an Australian newspaper, the above Association is to be formed in Sydney, with offices at 33, York Street. What led to its formation was the issuance in March last by the Electrical Trades Union of New South Wales of a log embracing conditions of labour, wages to be paid, &c., to the members of their union, and sending a copy to each of the firms employing electricians, suggesting that a conference be held between their representatives and representatives appointed by the employers, with a view of getting their special conditions accepted by the employers. It was quite impossible for the employers individually to deal with this matter, and a meeting was convened by Mr. A. J. Hanson in order that the employers might be brought together to consider the matter. At one of the meetings it was felt to be very desirable that an association of all electrical employers should be formed in order to deal with this particular subject, and with any other matters that might arise from time to time affecting the general welfare of employers in the electrical industry. On June 3rd it was decided that the Association should be formed, and the following officers were elected:—President, Mr. E. J. Erskine; vice-presidents, Messrs. W. A. Gosche and A. J. Hanson; general committee, Messrs. Forbes Mackay, J. E. Donoghue, Kendall, Waddell and Bell; treasurer, Mr. H. R. Sharp; trustees, Messrs. Handley and Warren; secretary, Mr. R. Burgin.

Copper.—The tendency of the market at present is rather obscured. We are informed (U.S. *Electrical World*, July 29th) that the managers of the Metal Exchange of New York have adopted the recommendations of a Committee which advises them to bring their system of selling copper into line with that in use in London. This involves quotations in tons of 2,240 lb., the grading of the copper under the term "standard," and the use of contracts worded as the London ones.

The same paper records a sale to the Western Electric Co. of about 12,000 tons, though it does not make direct mention of delivery. Presumably, however, this is a trading sale.

The trade "boom" appears to be setting in rapidly in the States, and would appear to have caused a reversal of policy in speculative circles. Indications hitherto have been all in favour of a "slump" in copper, to be followed by a sharp climb to high prices. In the face of a strong genuine demand in the States, however, it is difficult to see how this can come about.

Inquiries.—A correspondent wants a quantity of gas-heated thermopiles, and would like to meet with a maker of such.

A firm is inquiring for makers of electrical hammers for boiler riveting, or if not obtainable, for makers of hydraulic hammers for the same purpose.

Correction.—In the article on an "Electrically-Operated Fire Pump" on page 210 of our August 6th issue, reference is made to a "flexible cable of 60 sq. mm. section." This should read "16 sq. mm."; and two lines later for "3 × 60 sq. mm." read "3 × 16 sq. mm."

To Soothe a Savage Breast.—Although some of our electrical friends may now be tracking the wily grouse to his lair, there are many others left in empty (so-called) London, and to these we heartily commend a few evenings with the Moody-Manners Opera Company at the Lyric Theatre. This week these fine performers have given "Lohengrin," "Madame Butterfly," "Carmen," "The Mastersingers," &c., and music lovers who patronise only Italian and German opera, because it is the proper thing to do, will be pleasurably surprised and gratified with the superb singing and fine acting of the eminent vocalists Mr. Charles Manners has gathered into his fold. Principals, chorus and orchestra alike are first class; the chorus, indeed, is quite a feature, especially in the male-voice department, and the wonderful verve displayed, combined with a remarkable ability to retain the pitch, is a revelation in operatic chorus singing. On two consecutive evenings we have been gratified to note that the courage and enterprise of Mr. Manners have been rewarded with well-filled houses, and we hope that the recognition for which he has for years so manfully striven will no longer be denied him, for he deserves the hearty support of everybody to whom singing, acting, playing and scenic effects of the first order, appeal.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—On the occasion of his marriage, Mr. H. Wilson, mains superintendent, has been presented by the Maidstone electricity works staff with a marble clock.

In celebration of the recent marriage of Mr. Harold Dickinson, the manager of the Leeds Corporation Electric Lighting Department, a social gathering of the officers and workpeople, together with their wives and lady friends, was held at the Grand Central Hotel, on Friday evening, 13th inst., when Mr. Dickinson was presented with a grandfather clock and a silver tea and coffee service, and other articles subscribed for by the entire staff, numbering 237 persons. During the evening musical selections were rendered.

Tramway Officials.—Mr. Thomas Medcalf, general manager of the Swindon Corporation Tramways, and formerly in the electrical department of the Burnley Corporation, was married on Thursday last week, at Burnley, to Miss Alice Isabella Grey, daughter of Alderman Grey, cotton manufacturer, and chairman of the Burnley Corporation Electricity Committee.

General.—The directors of the Suffolk Electricity Supply Co., Ltd., and the staffs at Stowmarket, Diss, and Felixstowe, have presented a marble clock and a cheque for 10 guineas to Mr. Frank Allen (accountant) on his marriage.

Miss E. F. Lewis, supervising telephonist of the Northampton Post Office staff, who is about to be married to Mr. Wilfrid Austin, of the staff of the Northampton Electric Light and Power

Co., has been presented by the staff with an old Staffordshire china tea set and a silver-plated teapot.

Mr. A. W. Blake is severing his connection with the firm of Mills, English & Co., Ltd., Swansea, with whom he has been associated for the last three years (previous to which he was borough electrical engineer at Monmouth), and has taken offices at 66, Wind Street, Swansea, where he intends to practise as a consulting engineer, devoting special attention to colliery and works equipment.

Recently at the Parish Church, Plumstead, near Cape Town, the wedding was solemnised of Mr. George Muirhead Clark, M.I.C.E., chief engineer in South Africa for Harper Bros. & Co., of London, and consulting engineer to the Rand Mine Power Supply Co., and Miss May Constance Edwards, eldest daughter of Major J. P. Edwards, V.D., M.I.E.E., of Branksea, Wynberg, formerly chief engineer of the postal telegraphs in Cape Colony.

It was announced in Wednesday's papers that Sir Matthew Nathan, G.C.M.G., will be appointed Secretary to the Post Office in succession to Sir H. Babington Smith, K.C.B., C.S.I. He will take up his new duties in January next on returning from Natal. The *Times* says that Lieut.-Col. Sir Matthew Nathan, R.E., G.C.M.G., was born in 1862, and has had a distinguished administrative career. He entered the Royal Engineers in 1880, and served in the Nile and Lushai expeditions in 1885 and 1889. In 1895 he was appointed secretary to the Colonial Defence Committee. In 1899 he was entrusted with the administration of Sierra Leone, and subsequently was made Governor of the Gold Coast, and later of Hong Kong. He was appointed Governor of Natal in 1907.

Mr. Frank Stuart Milne, who some time ago left the Newcastle-upon-Tyne Electric Supply Co., Ltd., to take up an important appointment in the Argentine in connection with the electrical department of the State Railways, has, in view of the rapid commercial expansion of the Republic, commenced business in Buenos Ayres as commercial engineer and agent for British railway, mechanical and electrical engineering firms. Associated with him as British engineer and secretary is Mr. J. A. Seager, A.M.I.C.E., A.I.E.E., and any firms desiring representation in Argentina should communicate with the latter gentleman at his office, Emerson Chambers, Newcastle-upon-Tyne.

Obituary.—Hugh Erat Harrison. — We announce with very deep regret that Mr. Hugh Erat Harrison, B.Sc. (London), A.M.Inst.C.E., M.I.E.E., F.C.S., the Principal of the Electrical Standardising, Testing and Training Institution, died on Thursday, August 12th. Mr. Harrison was born at Westminster in 1859, and was educated at University College School. He matriculated in 1876, and entered University College, where he gained a Cloth Workers' Exhibition in Chemistry and Physics in 1877. He studied for a short time in Paris, and subsequently took his degree in 1880 with Honours in Experimental Physics. In the following year he entered the service of the Anglo-American Brush Co., and subsequently became managing engineer of the Sheffield branch of the Hammond Electric Light and Power Co., Ltd. In 1882 Mr. Harrison organised and became Principal of this company's Electrical Engineering College in Red Lion Square, London, and when it was closed in 1885 he became a partner in the firm of Phillips, Harrison & Hart. On retiring from this firm he was appointed Clerk to the Research Committee of the Institution of Mechanical Engineers, but it was in 1889 that he carried out the work with which his memory will be associated, viz., the organisation and foundation of the Electrical Standardising, Testing and Training Institution, Faraday House, London, of which he was Principal at the time of his death. He drew up the scheme of studies himself, and to the close of last term lectured to the students on "Electrical Engineering." In addition he organised the Testing Department and superintended its work, and in connection with this he was appointed Board of Trade Electrical Inspector for Croydon, Tunbridge Wells, Ealing, Wimbledon, Chatham, Godalming and Clacton. From 1887-1901 he was Assistant Examiner in Magnetism and Electricity to the Board of Education, and he was one of the delegates sent by the Institution of Electrical Engineers to attend the International Electrical Congress held at St. Louis in 1904. He at one time contributed largely to the technical Press, and he has also written two small text-books for the pupils of Faraday House, one upon "Graphics," and another on "Armatures" (first part); he was engaged in the preparation of the second part of the latter at the time of his decease. He specialised very considerably in alternate current work, and in 1893 the Editor of *Industries* credited him with "perhaps the most important discovery in alternating current work during the last few years." He was unmarried. Mr. Harrison was a man of wide reading, with a well-balanced mind and singularly clear judgment. He was, however, reserved almost to shyness, and shrank instinctively from anything approaching publicity. Nervous to a degree and highly sensitive, he was nevertheless possessed of great tenacity of purpose and strength of will, and those with whom he happened to come into active opposition were often astonished at the force he disclosed. His favourite recreations were golf and yachting, and he was an excellent walker, and for years made it a rule to walk at least 50 miles a week. Latterly, however, due to weak health, he was less active. Extremely fond of music, he at one time sang very well, and a few years ago he installed an organ at Sussex Place and played on it almost daily. One of his chief delights was curio hunting, especially in glass, and a competent judge expressed the opinion that his was the finest private collection of glass in this country. For reasons which we have mentioned above, he was perhaps not as well known personally as his position and abilities might have led one to expect, but to those who were intimate with him, his premature death has come as a terrible blow. Of no one could it more truly be said that "those who knew him best loved him most." The Faraday House Institution which he organised, developed and guided for nearly 20 years, will feel his loss acutely; his name had become synonymous with it, and the Institution of Electrical Engineers, who twice elected him a member of their Council, will feel the loss of his thorough learning and shrewd judgment. The funeral took place at Golder's Green on Tuesday, among those present being the Earl of Crawford, Chairman of the Governors of Faraday House; Mr. W. M. Mordey, President of the Institution of Electrical Engineers; Messrs. Robert Hammond, C. P. Sparks, W. R. Cooper, J. E. Kingsbury, H. M. Hobart and Dr. Alexander Russell.

William Ford Stanley.—We regret to place on record the death, at the well advanced age of 81 years, of Mr. W. F. Stanley, whose name had for so long stood out very prominently among the scientific instrument makers of the United Kingdom, indeed of the world. It was some 55 years since he commenced business as a metal and ivory worker, and, according to the *Times*, two years later he brought out the first simple open stereoscope. For many years he had been engaged designing and manufacturing all classes of scientific instruments for Government and other purposes, and he also wrote a number of text-books on the subjects in which he had so successfully specialised. He shared his success with the people of the neighbourhood in which he resided, for upon South Norwood he poured out his wealth with exceptional munificence. A public hall and art gallery, costing £13,000, the Stanley Technical Trade Schools, erected and equipped and amply endowed, representing many thousands more, and other gifts, led to Mr. Stanley having the honorary freedom of Croydon conferred upon him a couple of years ago, and to the unveiling of a clock tower in South Norwood.

M. Wilson, Sen.—Those who have had dealings with the Electrical Standards Laboratory of the Board of Trade will learn with regret of the death, after only one day's illness, of Mr. M. Wilson, sen. He had served in the R.E. as sapper for over 21 years and held for seven or eight years the office of storekeeper whilst acting as laboratory assistant at the Chatham School of Military Engineering under Major P. Cardew. He has held the office of assistant electrician and mechanic to the Board of Trade Electrical Standards Laboratory since its inception in 1890, and the wide range of practical knowledge which he brought to bear on his duties made his services highly appreciated by all with whom he came into contact.

Sydney Holmes. — We regret to learn that Mr. Sydney Holmes, traffic superintendent of the Rhondda Tramways Co., was drowned on Saturday last. He was bathing in the Bristol Channel at Penarth, when he got beyond his depth and was carried away by the current.

NEW COMPANIES REGISTERED.

Dynamic Electrical Co., Ltd. (104,436).—This company was registered on August 6th, with a capital of £100,000 in £1 shares, to acquire all or any of the undertakings, businesses, properties and assets of the Dynamic Syndicate, Ltd., the Dynamic (French) Syndicate, Ltd., and the Mitcham Electric Fan Co., Ltd., to adopt agreements with the said companies and the liquidators thereof, and to carry on the business of electricians, engineers, makers and manufacturers of and dealers in electric and other motors, fans, dynamos, tools, induction coils and other machinery and electrical apparatus, &c. The subscribers (with one share each) are:—C. Simpson, 34, Down Street, W., stock jobber; T. H. Weguelin, 18, Clifford Street, W., stock jobber; B. H. Weguelin, Coombe End, Kingston Hill, stock jobber; J. Fairbairn, 6, Broad Street Place, E.C., manager; C. T. Treacher, 97, Ridgmount Gardens, Francis Street, W.C., estate agent; J. Berry, 6, Broad Street Place, E.C., secretary; A. Goodlett, 6, Broad Street Place, E.C., chartered secretary. Minimum cash subscription, seven shares. The number of directors is not to be less than three or more than nine; the first are C. Simpson, T. H. Weguelin, and B. H. Weguelin; qualification of first directors, one share; of other directors, £100; remuneration (except managing director) £200 each per annum, free of income-tax (chairman, £250).

General Accessories Co., Ltd. (104,464).—This company was registered on August 9th, with a capital of £8,000 in £1 shares (1,580 6 per cent. preference, 920 5 per cent. preference, and 500 ordinary), to carry on the business of manufacturers of and dealers in electrical goods of all kinds, general merchants, warehousemen, factors and agents, &c., and to adopt an agreement with E. C. Friend. The subscribers (with one share each) are: A. T. Richards, 20, Hanbury Road, Hornsey, N., clerk; Miss M. M. Marlow, 49, Dewhirst Road, Brook Green, W. Private company. The number of directors is not to be less than two or more than five; G. X. Markt is permanent director and manager with £391 10s. per annum. Registered office, 148-150, Curtain Road, E.C.

Laing Wharton, Ltd. (104,536).—This company was registered on August 12th, with a capital of £3,000 in 2,900 preference shares of £1 each and 2,000 ordinary shares of 1s. each, to carry on the business of electricians, mechanical engineers, makers of and dealers in electricity, suppliers of light, heat and power, &c. The subscribers (with one ordinary share) are:—W. R. Wildridge, 95, New City Road, Plaistow, clerk; J. W. G. White, 8, Harrogate Road, South Hackney, N.E., clerk. Private company. The number of directors is not to be less than two or more than five; the first are H. P. Allison and H. J. de Courcy Moore; qualification, one share. Registered by H. J. Moore, 2, Gresham Buildings, Basinghall Street, E.C.

Geary, Adams & Co., Ltd. (104,463).—This company was registered on August 9th, with a capital of £3,000 in £1 shares, to adopted an agreement with F. C. Geary, and to carry on the business of electrical installation and general engineers and agents, &c. The subscribers (with one share each) are:—F. C. Geary, 20, Albany Road, Wolverhampton, engineer; G. W. M. Adams, Bolton Road, Wednesfield, Staffs., secretary. Private company. The number of directors is not to be less than two or more than five; the first are F. C. Geary and G. W. M. Adams (all permanent; no qualification required); remuneration as fixed by the company. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

Midland Electric Wire Co., Ltd. (104,571).—This company was registered on August 14th, with a capital of £5,000 in £1 shares, to acquire the business carried on as the Midland Electric Wire Co., and to carry on the business of electric cable and insulated wire manufacturers and dealers, electricians, engineers, &c. The subscribers (with one share each) are:—W. J. Levi, 154, Fosse Road South, Leicester, electrical engineer; Miss E. E. Levi, 154, Fosse Road South, Leicester; G. A. Orme, 27, Abney Street, Leicester, secretary; H. W. Griffin, 23, St. Albans Road, Leicester, managing clerk; G. Hall, Pendene, Stoneygate, Leicester, merchant. Private company. W. J. Levi is manager. Registered by Rawle, Johnstone & Co., 1, Bedford Row, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Walter's Electrical Manufacturing Co., Ltd. (94,800).—This company's annual return was filed on July 2nd, when 10,507 shares had been taken up out of a nominal capital of £13,000 in £1 shares. £1 per share has been called up on 507 shares, resulting in the receipt of £507. £10,000 is considered as paid. Mortgages and charges: £2,600.

Spanish Telephone Co., Ltd. (41,589).—This company's annual return was filed on July 19th, when 8,600 ordinary and 671 preference shares had been taken up out of a nominal capital of £61,000 in 3,600 ordinary shares of £10 each and 1,250 preference shares of £20 each. £20 per share has been called up on 671 preference, and £10 per share on 2,000 ordinary shares, resulting in the receipt of £33,420. £16,000 is considered as paid on 1,600 ordinary. Mortgages and charges: Nil.

J. G. White & Co., Ltd. (66,568).—This company's annual return was filed on July 19th, when the entire capital of £200,000, in 15,000 preference shares of £10 each and 50,000 ordinary shares of £1 each, had been taken up. £10 per share has been called up on the preference, resulting in the receipt of £150,000. £50,000 is considered as paid on the ordinary. Mortgages and charges: Nil.

Electrolytic Alkali Co., Ltd. (64,360).—Particulars of £50,000 first mortgage debentures, created July 12th, 1909, and secured by trust deed of even date (supplemental to a trust deed dated July 9th, 1904), filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £40,150. Above supplemental deed also registered. Property charged: Certain freehold land, buildings, plant and machinery at Middlewich, and the company's other property, present and future. Trustees: Liverpool Mortgage Insurance Co., Ltd., 6, Castle Street, Liverpool.

Cryselco, Ltd. (58,218).—Particulars of £5,000 first and £5,000 second debentures created by resolutions of June 26th, and secured by trust deeds dated July 11th, 1905, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of present issues being £500 of each series. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: A. Baker, Billiter House, Billiter Street, E.C.; and H. S. Deacon, Kempston, Bedford.

CITY NOTES.

Great Northern, Piccadilly and Brompton Railway Co.

The twenty-second half-yearly meeting of the above company was held on August 12th, at Hamilton House, under the chairmanship of Sir Geo. S. Gibb, who, in moving the adoption of the report (see Electrical Review, August 13th, page 267), said the issue of share capital to the contractors had now been completed. £75,000 of debenture stock was issued to the contractors during the past half-year, and there remained about £227,000, the bulk of which would remain unissued, representing the capitalised value of rent charges created. The number of passengers carried had been 19,155,883, an increase of 1,709,000, or 9·8 per cent. The increase in two years had amounted to the very handsome percentage of 60½. The local traffic was 68¾ per cent. of the total, and the increase in that branch had been about 2½ per cent. The through traffic was 31¼ per cent. of the total, and the increase in that branch had been 30½ per cent. The gross revenue was £157,993, an increase of £10,229, or 6·9 per cent. He had practically no comment to make on the working expenses, which showed a decrease of £1,578. They ran an increased number of trains, and a decreased number of cars. The service was working with the greatest regularity and success. They only wanted more revenue, and that was coming as fast as one could reasonably expect it. The net revenue balance was £84,588, out of which the directors had set aside £6,000 as reserve for contingencies and renewals. After providing for the preference dividend, the directors recommended the payment of a dividend of 1 per cent. on the ordinary shares and the carrying forward of £8,352. A great deal of new and useful experience was being gained in the working of the railway. No one could say beforehand what kind of movement would take place, and to what extent they would succeed in attracting short-distance passengers, and it was satisfactory to note the increase in the number of passengers who paid the larger fares. They carried 3½ millions of local passengers who paid 3d. during the half-year, and the increase in that branch of their traffic was 12 per cent. The increase in the number of passengers who travelled at 2d. fares was only 1·59 per cent., so that it would be seen they had a good increase in the number of those who paid the larger fares. They also found they got quite a considerable number of short-distance passengers. They had carried 2½ millions at 1d. and 1½d., which was nearly 24 per cent. of their local traffic, excluding workmen. No doubt these fares were too low, but if one could not get more, the traffic of these 1d. and 1½d. fares did at least add to the revenue. They had lately taken out a statement showing the average distances that their passengers travelled. It was a week's account of a week's traffic, and it went to show that those passengers who paid 1d. per fare travelled on the average ·85 of a mile. Passengers who paid 1½d. fares went 1·27 miles, so that the rate per mile paid by those passengers was 1·17 and 1·18 respectively. Taking the whole of the traffic, through and local together, the average distance travelled was 2·9 miles. The average recepts for through passengers, taking the whole length of the journey, was about 2·98d. Of course, some of this had to be divided between the various companies, so that their share had been about 1·66d. The average receipts for the whole of their traffic were 1·89d.

Lord George Hamilton seconded the motion, and the repor was adopted without discussion.

Mersey Railway Co.

The directors' report for the half-year ended June 30th, 1909, states that the train-mileage run during the half-year was 384,962 miles, as compared with 408,134 during the corresponding six months of 1908. The passengers conveyed were 5,818,759, as against 5,719,572, exclusive of season-ticket holders. The total receipts from all sources were £53,228, as compared with £51,784. The working expenses, exclusive of the charges for pumping, ventilation and lifts, have been £30,810, equal to 57·88 per cent., as against £33,075, equal to 63·87 per cent. for the corresponding six months. These charges for pumping, ventilation, and hydraulic lifts, for the past half-year amounted to £3,660, equal to 6·88 per cent., as compared with £4,070, or at the rate of 7·86 per cent. for the corresponding period of 1908. The London office has now been closed, and the whole of the staff connected with the administration of the company has been concentrated at the general offices at the Central Station, Birkenhead. The period during which the payment of interest on the debenture stocks (other than the new first perpetual stock) is contingent on the revenue available in each separate year, and the holders of each of these stocks are entitled to appoint a director, will expire on December 31st, 1910, and the directors recommend that an application should be made to Parliament during the present session for a further extension of the period. In view of the progress which continues to be made in the development of the traffic and the reduction of the expenditure, the directors are unanimously of opinion that in the interest of all the classes of debenture stock holders and also of the holders of the preference and ordinary stock, it is desirable to continue the existing arrangement and maintain the credit of the undertaking. They hope at an early date to submit proposals for that purpose.

Liverpool Overhead Railway Co.

The half-yearly meeting was held at Liverpool on Tuesday, Sir Wm. Forwood presiding.

The Chairman, in moving the adoption of the report (Electrical Review, August 13th, page 267), said that there was a further shrinkage in revenue, amounting to £2,487, which was mainly, if not entirely, due to depression in trade. On the other hand, the reduction in the working expenses had saved £3,138. This had been accomplished mainly by a more frequent, but less rapid, and therefore less expensive train service. The directors had also effected other economies, small in themselves, but in the aggregate amounting to a considerable sum. They had not sacrificed efficiency for economy. The economies had mainly been effected in running expenses, and not in the cost of repairs and renewals. The railway and rolling stock had been well maintained, and had not been allowed to run down. He was not confident that they would ever be able to restore their fares to their former level. They were governed by the fares charged upon the Corporation tramways and the Lancashire and Yorkshire Railway. It was one of the evils of a municipal trading concern like the tramways, that they must be worked upon popular lines, rather than upon business principles. There had been a severe depression of trade, which had greatly affected the Liverpool Docks. A recovery, however, was already in progress. In America the rising tide in trade had set in vigorously, and it could not be long before it reached this country. He could see no reason why their traffic should not shortly be again as large as it was four years ago. Liverpool, after all, remained the greatest port in the Empire; it was to-day the only commercial port in the United Kingdom, which a modern Atlantic liner could enter, and was the nearest port to the great manufacturing centres. The outcome of their half-year was that they carried a balance to their net revenue account of £7,601. To this they added the balance brought in from last half-year of £4,210, and interest £214, making the total available £12,026. Deducting interest payable upon their mortgage debentures £4,171, and interest payable upon calls paid in advance, they had left a balance available for dividends of £7,696. They proposed to pay interest on the 1892 preference shares at the rate of 5 per cent., which would require £3,000, leaving £4,696 to be carried forward. They had carried £1,500, as usual, to the credit of the renewal fund, which now amounted to £38,082, and they had thought it wise to strengthen their contingent fund by crediting it with £200.

Mr. G. H. Robertson seconded, and the report was adopted.

It was resolved to pay a dividend of 5 per cent. on the preference shares.

Direct Spanish Telegraph Co., Ltd.—The board have decided to pay, in addition to the dividend at the rate of 10 per cent. per annum on the preference shares, an interim dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, both for the half-year ended June 30th, 1909, and payable on October 1st next.

Baker Street and Waterloo Railway Co.

Sir Geo. S. Gibb (chairman) presided on August 12th, at Hamilton House, over the twenty-second half-yearly general meeting of the above company.

In moving the adoption of the report (see Electrical Review, August 13th, page 267), he said the accounts showed a considerable improvement in all the main features to which one looked in studying railway accounts. Their receipts had gone up, their expenses had gone down, and they were able to double the small dividend which was declared in the first half of 1908. The capital account was not now of much interest. It showed capital expenditure of £71,880, but that merely represented the balances issued to contractors. They had carried 14,300,000 passengers, which was an increase of nearly 11 per cent. over the corresponding half of 1908. The increase had mainly occurred in through passengers. Through passengers in the June half of 1908 were 36⅛ per cent. of the total, and they were now 40¼ per cent. The through traffic did not yield quite so much money as the local, as they had to divide the receipts with the other companies concerned, but it was to the increase of through traffic, due to the co-operation of all the companies in their efforts to establish the habit of underground traffic, that they looked for considerable advantage in the future. The average payment by through passengers came to 2·8d., and the company's share of that was 1·3d. The average of their local traffic, including workmen, was 1·54d., and the average of the total traffic, both through and local, was 1·46d. Their principal exchange was with the Piccadilly Tube, with whom they exchanged about 1¾ million passengers. Next came the Central London Railway, with whom they exchanged 1¼ million; next the Metropolitan Railway, with just over 1 million; and then the City and South London, with just under 1 million. The gross revenue was £91,510, an increase of £7,931, or 9·56 per cent. The working expenses, notwithstanding the increase of car-mileage, showed a decrease of £3,228, of which £2,100 occurred under the head of train-working, and was largely due to the decreased price of electric current, which, again, was due to the decreased price of coal. They had that year put £4,000 to reserve, as the board thought the time had come when they should establish a fund for contingencies and renewals. After that reserve, there remained a balance of £18,304, out of which the directors recommended the payment of the 4 per cent. preference dividend; dividend of 1½ per cent. on the ordinary shares; and an additional dividend of 1½ per cent. on the shares held by shareholders other than the Underground Co.—that company having consented to waive the claim to their dividend. This left £1,305 to be carried forward to the next half-year. The total working expenses worked out at an average of ·71d. per passenger, which was an exceedingly low figure. It was interesting to consider that figure as showing that the large number of passengers they carried at 1d. and 1½d. fares did make some slight contribution to the company. They were aware that the company was authorised to extend the railway from Edgware Road to Paddington. Originally it was proposed to have a terminus in Bishop's Road and then the plans were altered to have the terminus in Praed Street. There was an idea with some people that the Bakerloo Railway should be debarred from extending the line beyond Paddington. He confessed when he looked into the matter it seemed unwise and unfair in the interests of both the company and the public that a permanent physical barrier should be placed in the way of further extensions beyond Paddington. He would not like to express at that time the desirability of such an extension, but the company ought to be perfectly free in a matter of that sort. He did not think the construction of a short length of line between Edgware Road and Paddington would be profitable, for the idea that a large trunk line yielded a large traffic to a line like theirs was quite a mistake. A much better gathering ground was a populous well built district. After careful consideration, therefore, the board had no hesitation in recommending the abandonment of the existing powers for the Paddington extension. The North-West London Railway Co. was authorised to make a tube railway from Victoria to Cricklewood, but had come to the conclusion that the line from Edgware Road to Victoria could not pay—a conclusion which he personally thought a wise one. The promoters approached them with the statement that they wished to abandon the piece of line from Edgware Road to Victoria and to construct a line from Edgware Road to Brondesbury if the Bakerloo Co. would work that piece of line as a continuous line with theirs. The details were very carefully worked out, and a working agreement was settled. The Bakerloo was to have nothing to do with the construction of the line, but was to give an annual contribution out of the through receipts, and the line was to be worked as an extension of the Bakerloo Railway. The financial result, they estimated, would have shown a payment to the Bakerloo line of something like £25,000 to £30,000 a year. That line would, be thought, have been a much more valuable feeder than the Paddington extension. The promoters' Bill was, however, rejected. He did not suppose this would be an end of the matter. He understood that the promoters were considering what they should do, and it was clear there was a very active desire on the part of the inhabitants of the district that the Bakerloo line should be extended to this district. If the scheme was again brought forward they would welcome it, and would be prepared to arrange a similar working agreement with the promoters. This might not occur next session, but he did not know. He saw that the L.C.C. were considering the promotion of trams down the Edgware Road, but whether they would pass Parliament no one knew. Some years ago a similar proposal met with great opposition on the part of the promoters, and was rejected. In any case, so far as that company was concerned, it was clearly their right policy to keep themselves quite clear for any development which might occur. As they knew, the Underground Co. guaranteed 3 per cent. on their shares during construction, and, of course, the abandonment of the Paddington extension would terminate the guarantee. It was clear, however, that the company must look to its permanent interests, and these would be best served by such abandonment of the extension.

Mr. A. Willis seconded the motion.

A Shareholder asked if the company got the advantage of any improvements in the cost of generating electric current by the Underground Co.

The Chairman said they did so.

The report was then adopted.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

British Columbia Electric Railway Co., Ltd.—Further issue of £500,000 4½ per cent. perpetual consolidated debenture stock.

and to allow the following securities to be quoted in the Official List—

Bombay Electric Supply and Tramways Co., Ltd.—£150,000 5 per cent. second mortgage debentures, in lieu of the scrip now quoted.

Mexico Tramways Co.—£1,250,900 6 per cent. 50-year mortgage bonds, in lieu of the scrip now quoted.

Oriental Telephone and Electric Co., Ltd.—Further issue of £50,000 4 per cent. redeemable debenture stock.

Liverpool District Lighting Co., Ltd.—An interim dividend, at the rate of 4 per cent., has been declared for the past half-year.

Metropolitan District Railway Co.—Sir George Gibb, presiding at the half-yearly meeting held at Westminster Palace Hotel on August 11th, expressed satisfaction at the results shown in the report (see Electrical Review, August 13th, page 265), the passengers carried having increased by 11·22 per cent. as compared to the corresponding half of the previous year. That improvement occurred nearly all over the system. The passenger receipts at £254,000 exceeded by £10,900 the receipts of any previous half-year. Season ticket receipts were up by 34 per cent. The average receipt per passenger was 1·85d. The car-mileage had increased by 6½ per cent. An expenditure of £5,600 upon the alteration of the air-worked doors to doors having handles, had made it possible to dispense with an excessive number of staff on the trains; these men had been absorbed into the general staff. The new doors were satisfactory and economical, for on the present car-mileage, air-worked doors would have cost an additional £8,000 per annum. There was a net saving of £8,545 in the cost of current this half-year. The accumulated deficiency on the 4 per cent guaranteed stock was about 20 per cent. of the nominal value of the stock, and the board was now engaged considering a scheme, based on mutual concessions of the guaranteed and first preference stockholders, for capitalising the deficiency. A meeting will be called later to consider this scheme, with a view to promoting a Bill in Parliament.

Crossley Brothers, Ltd.—The *Financial News* says that the directors have declared an interim dividend of 2 per cent. (actual), against 2½ per cent. (actual) a year ago.

Chloride Electrical Storage Co., Ltd.—A financial daily says that the directors recommend a dividend for the past year of 10 per cent, placing £5,000 to reserve and carrying forward £14,200.

Northampton Electric Light and Power Co., Ltd.—The directors have declared an interim dividend of 4½ per cent. per annum (5⅝d. per share), less income-tax, on the "B" ordinary shares for half-year, payable 17th inst.

North Metropolitan Tramways Co., Ltd.—Mr. G. Richardson presided at Electrical Federation Building on 13th inst., over the annual meeting of the above company. He said that there was no alteration in the position since the last meeting. In the next report they might be able to recommend a small dividend. Mr. J. Devonshire seconded the adoption of the report.

Electric Supply Co. of Victoria, Ltd.—The report for the year ended March 31st shows, after payment of debenture and other interest, a credit balance of £7,760, and, with the amount brought forward, there is an available total of £16,342. Deducting the preference dividend to March 31st, 1908, and £3,962 for debenture stock redemption account, there remains (says the *Times*) a balance of £4,581. The dividend on the preference shares to March 31st, 1909, amounts to £8,250.

Switzerland.—The report of Messrs. Brown, Boveri and Co., of Baden, for the last financial year shows a net profit of £100,112 as contrasted with £94,058 in the preceding 12 months.

Lanarkshire Tramways Co.—The sixteenth ordinary general meeting of this company was held on Wednesday, at the London Offices, 83, Cannon Street, Mr. A. R. Monks, presiding. The Chairman formally moved the adoption of the report (see Electrical Review, August 13th) which was seconded by Mr. H. C. Levis and carried.

MARKET QUOTATIONS.

Wednesday, August 18th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac, Sal	,,	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a ,, ,,	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon	,,	£12	..
a Copper Sulphate	,,	£18 10	..
a Lead, Nitrate	,,	£26 10	£1 inc.
a ,, White Sugar	,,	£23 10	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	3½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	74/-	4s. inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70 %)	,,	£10 15	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a ,, Cyanide (basis 100 %)	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	£10 inc.
b ,, Wire, in ton lots	,,	£112	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£50 to £136	inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅞d.	..
c ,, Tube (brazed)	,,	8¼d.	..
c ,, ,, (solid drawn)	,,	7⅞d.	..
c ,, Wire, basis	,,	6⅞d.	..
c Copper Tubes (brazed)	,,	8¼d.	..
c ,, ,, (solid drawn	,,	8¾d.	..
g ,, Bars (best selected)	per ton	£72	£1 inc.
g ,, Sheet	,,	£72	£1 inc.
g ,, Rod	,,	£72	£1 inc.
e ,, (Electrolytic) Bars	,,	£61 10	£1 5 inc.
e ,, ,, Sheets	,,	£78	£1 inc.
e ,, ,, Rod	,,	£66	£1 inc.
e ,, ,, H.C. Wire	per lb.	8d.	¼d. inc.
f Ebonite Rod	,,	9/3	..
f ,, Sheet	,,	9/-	..
n German Silver Wire	,,	1/6	..
h Gutta-percha, fine	,,	5/6 to 6/6	..
h India-rubber, Para fine	,,	2/8½	1¼d. dec.
f Iron Pig (Cleveland warrants)	per ton	50/5	10d. inc.
f ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Ingot	,,	£12 15 to £12 17 6	..
m Manganin Wire No. 28	per lb.	6/6	1/6 dec.
e Mercury	per bot.	£8 5	..
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	1/- to 1/1½	inc.
p ,, ,, rolled bars & rods	,,	1/1½ to 1/3	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/6	..
o Platinum	per oz.	99/-	variable.
c Silicium Bronze Wire	per lb.	9½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£133 10 to £134 10	£2 inc.
n ,, Wire, Nos. 1 to 16	per lb.	1/8½	..
p White Anti-friction Metals :—			
"White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£25 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Prospectuses. — *Membakut Rubber, Ltd.* — 100,000 guaranteed shares of £1 each have been offered for subscription at par. The concession consists of 5,000 acres near Beaufort, in British North Borneo, whereon Para rubber is to be cultivated. The Government guarantees 5 per cent. dividend for the next six years, and will not charge any export duty on rubber grown on the estate for 50 years from 1905.

Sendayan (F.M.S.) Rubber Co., Ltd.—40,000 shares have been offered at par. It is estimated that on the 820 acres already planted with Para rubber, there are 135,500 trees ranging from eight months to nearly three years old.

Charing Cross, Euston and Hampstead Railway. —The 26th ordinary half-yearly meeting of this company was held at the offices, Hamilton House, Victoria Embankment, on Thursday of last week. Sir George Gibb presided over the proceedings, which were purely formal, and the report was adopted.

STOCKS AND SHARES.

Tuesday Afternoon.

In some few departments of the Stock Exchange there is a fair amount of business going on. Easy money tends to divert capital into the investment markets. American Rails are having wild bursts of excitement—and Anglo-American Telegraph Deferred thereout draws no small advantage. Rubber shares are fairly animated, with prices moving irregularly. And the Canadian-Mexican group is good.

Of this week's new issues, the most interesting in at least one respect is the Membakut Rubber, Ltd. The company receives a guarantee from the Government of British North Borneo of a minimum 5 per cent. dividend for six years, after which the shareholders who desire to get out will have the right to sell the shares to the same Government at par, the purchase to be satisfied either by cash or the issue of certificates bearing 5 per cent. interest. The novel departure opens up all kinds of future vistas, and the speculative fancy wonders what shape of attraction will come next. The chairman of the Membakut Rubber, Ltd., is also managing director of the British North Borneo Company.

Following up a substantial rise last week, Mexican Light and Power common stock has gained a further 2 points, and the Preferred and 5 per cent. bonds are both 1 better. Mexico Tramways rose 3½, though the company's 5 per cent. bonds are ½ down. Rio Trams, at 93½, showed an advance of 3, and Sao Paulos put on 1 at 151½. Canadian General Preferred is 1½ higher at 119½, the Ordinary remaining at 123.

This change in the market within a fortnight is due as much to bear purchases as to investment support, although the latter, encouraged by the substantial fall that had taken place, was not wanting. The chief volume of business is in Rio Trams and Mexican Light and Power Common, the rest of the market obediently pursuing the paths of prices marked out by the two leaders.

The re-arrangement of the Anglo-Argentine Tramways capital is now practically complete, and a steady trade has developed in the First and Second Preference shares of the company. The respective prices are 4⅛ and 4⅝, while the 4 per cent. Debenture has risen 1¼ this week, standing now at 92½. The 4½ per cent. Redeemable Debenture stock is 95½ middle. United Electric Trams of Monte Video are quiet at 5½, and the 6 per cent. Cumulative Preference were done at the same price the other day. A seller of British Electric Traction 5 per cent. Perpetual Debenture got 56 for his stock. British Columbia Electric Tramways Deferred is a point harder, and Calcutta Trams are slightly better.

Sensational fluctuations in Anglo "A" are the outstanding feature of the Telegraph market. At one time the price was whirled up to 20⅝, to return below 20. That the prosperity of United States trade and the activity in the American Railroad market are jointly influencing good traffics over the cables there can be no doubt, but whether Anglo "A," on dividend merits, will be worth more than 20 for some time to come is open to question. The company's Ordinary and Preferred stocks are both a point higher. Other American cable companies' issues have not moved, and this is by some people construed as meaning that there may be more in the Anglo "A" rise than meets the casual eye.

Eastern Telegraph stock rose 3, upon a little steady buying by investors. On the other hand, Eastern Extension shares are ¼ lower, which seems paradoxical, since the two generally, and appropriately, move in company. Alterations in the rest of the telegraph list are mainly confined to a few rises of about ½ each in some of the Debenture stocks, and telephone descriptions are also quiet. United River Plate Ordinary rose a small fraction, and National Telephone 4 per cent. Debenture went a trifle over par. American Telephone fell a point.

The Railway division is fairly firm, and there are a few rises, of no particular significance. City and South London has improved, and the quiet advance of Central London Ordinary stock continues, allowance being made for the dividend. The prospect of an Anglo-Japanese Exhibition at Shepherd's Bush next year, under direct patronage of royal and other powerful houses, encourages the hope that the summer of 1910 should be a very good one for the Central London and the Metropolitan Railways. Metropolitan Consolidated is steady at 40¼, but Districts yielded ¼ on the hottest day, when it was observed that London General Omnibus stock rose 2. Even now the price of the latter is only half a dozen points above the quotation for Districts, and the chances of a dividend on either look equally rosy. Metropolitan Pre-ordinary stocks are hardening in value, and to obtain the offer of any amount of stock becomes more and more difficult.

Electricity Supply shares suffer from the usual dog-days depression. Brompton Ordinary are 10s. down, of which 4s. 6d. is accounted for by the dividend. The deductions from Charing Cross shares have been accompanied by no change in the nominal prices, and Metropolitan Ordinary, *ex* 2s. 6d., are left at their previous level. Chelseas have risen 5s. Newcastle-on-Tyne shares were marked down to 4¼, but there is no real market in the shares.

Manufacturing varieties remain strong, and where movements occurred they were mostly rises. Callender's and Henley's are better. Castner-Kellner's recorded a small advance. The rest of the shares in this department are not altered nominally, but actually they are a little firmer on balance.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Aug. 10th.	Closing Quotations Aug. 17th.	Business done week ended Aug. 17th, 1909. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amason Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅜ — 3½	2⅜ — 3½	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,950 Red.	100	5 %	5 %	5 %	5 %	93 — 96	93 — 96	..	..	..	5 4 2
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½ %	8 %	8 %	8 %	146 —147	145 —146	..	..	—1	5 9
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 0
558,460	Anglo-American Telegraph	Stock	33⅓%	33⅓%	33⅓%	£3 4s.	59 — 61	60 — 62	..	..	+1	5 4 2
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	102 —103	103 —104	103⅞	103⅜	+1	5 15 5
3,220,770	Do. do. do. Deferred	Stock	⅛	12½	1	8/-	19⅛ — 19⅜	19⅛ — 19⅜	20⅛	19⅜	+ ⅛	2 0 4
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	103 —105	103⅛ —105½	..	..	+ ½	4 14 9
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8 — 8⅜	..	..	..	4 14 1
2,431,850	Commercial Cable, Sting. 500 year 4% Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	90 — 92	90 — 92	92	91½	..	4 7 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8½ — 9	8½ — 9	8⅝	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞ — 3⅛	2⅞ — 3⅛	..	..	..	5 3 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¼ — 8½	8¼ — 8½	..	..	..	5 12 8
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 16 8
60,710‡	Direct United States Cable	20	4½%	4½%	4½%	4½%	12⅝ — 13⅛	12⅞ — 13⅛	13½	13½	..	6 13 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,300, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	126 —129	129 —132	130½	129	+3	5 6 1
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	84½ — 86½	84½ — 86½	85½	84½	..	4 9 0
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½ —106½	104½ —106½	..	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅛ — 12	11⅛ — 11⅞	11⅞	11⅞	— ⅛	5 17 11
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
800,000‡	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	5½%	10½ — 10⅞	10½ — 10⅞	10⅝	10½	..	5 7 0
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13⅝ — 14	13½ — 14	13⅞	13⅞	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen ..	10	24%	20 %	20 %	18 %	26½ — 27½	26½ — 27½	..	..	..	3 12 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,900, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½ — 53½	51½ — 53½	..	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	2½%	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	74 — 78	..	..	— ½	5 2
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅞ — 1	⅞ — 1	..	..	..	6 0 7
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 13 3
2,235,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 —107½	106 —107½	106½	106	..	5 11 7
5,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	123 —125	123 —125	124	123	..	4 16 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅞ — 6⅛	5⅞ — 6⅛	5⅞	..	..	4 7 3
9,000,000	Do. do. 5% % Deb. Stock Red. ..	Stock	5½%	5½%	5½%	5½%	99 —100	98 —100	99	98⅝	..	5 10 0
1,988,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	99½ —101½	101	100	+ ⅛	3 18 10
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅝ — 1⅞	1⅝ — 1⅞	38/1⅛	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 8 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	85 — 87	85 — 87	86½	..	..	4 12 0
99,400	Pacific & European Tel., 4 % Guar. Debr., 1 to 1,000	10	4 %	4 %	4 %	4 %	99 —101	99½ —101½	..	..	+ ⅛	3 18 10
11,888‡	Reuter's	8	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99 —101	99½ —101½	100½	..	+ ⅛	4 8 8
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 —133	130 —132	..	..	..	4 10 11
130,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞ — 7⅛	6⅞ — 7⅛	7⅛	7⅛	+ ⅛	5 11 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000 ..	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 13 8
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	..	1⅛ — 1⅜	1⅛ — 1⅜	22/6	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —101	99½ —101½	..	..	+ ⅛	3 18 10
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13½ — 14	13⅝ — 14	13⅝	13½	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102½ —104½	102½ —104½	..	..	..	3 16 7
88,831	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	6 %	6 %	6 %	8 — 8½	8 — 8½	..	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	17 2 4
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅛ — 4⅜	.. ..	96/10½	95/-	..	5 5 3
500,000	Do. 5 % 2nd Pref., 800,001 to 1,500,000	5	..	..	..	..	4 7/16 — 4⅛	.. ..	90/-	..	..	4 6 0
978,280	Do. 4 % Deb. Stock	..	..	..	..	4 %	90½ — 91½	92 — 93	92⅜	91⅜	+1½	4 16 2
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 9 11
680,000	Babcock & Wilcox, 1 to 680,000	1	20 %	20 %	20 %	20 %	4/16 — 4/7/16	4/16 — 4/7/16	..	..	..	4 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	48 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	1⅞ — 2	1⅞ — 2	..	..	..	18 13 4
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1⅞ — 2	1⅞ — 2	..	..	..	18 11 5
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3 — 3⅛	3 — 3⅛	..	..	..	5 14 3
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2⅞ — 3⅛	2⅞ — 3⅛	..	..	..	5 14 7
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	93 — 96	93 — 96	..	..	..	5 7 5
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	144 —148	145 —149	148½	148	+1	4 16 0
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 —125	121 —125	123	..	..	4 10 11
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110	107 —110	109½	..	..	4 6 7
288,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	Nil
188,301	British Electric Traction	10	8 %	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	6 0 0
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2 — 2⅛	2 — 2⅛	..	..	..	5 16 3
1,478,558	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	85 — 88	85 — 88	86½	85	..	6 14 4
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	63 — 67	63 — 67	..	..	..	6 9 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅜ — 7⅞	7⅜ — 7⅞	7⅞	..	..	4 11 8
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6¼ — 6⅝	6¼ — 6⅝	6⅛	..	..	4 4 11
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 18 11
804,941‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	Nil
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	7/16 — 7/8	7/16 — 7/8	6/3	..	..	9 10 6
1,015,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	Nil
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	11/16 — 13/16	11/16 — 13/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/8 to 15/8	14/8 to 15/8	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	9 8 8
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	45½	..	..	14 10 2
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	4 12 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4½ — 4⅞	4/16 — 4/8	97/4½	..	+ 1/16	5 0 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,380..	5	5 %	5 %	5 %	5 %	4/16 — 5	4/16 — 5	..	..	..	4 10 0
250,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 —100	97 —100	99½	99	..	6 16 6
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10⅞	10⅛ — 11	10⅞	10⅛	+ ⅛	4 13 1
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	5⅛	..	..	4 4 5
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104½ —106½	104½ —106½	104½	..	..	Nil
491,229	Cape E. Trams., 1 to 491,229	1	Nil	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	6 0
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	1⅝ — 2	1⅞ — 2⅛	40/6	40/-	+ 1/16	6
910,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	104 —107	105 —108	..	..	+1	3 14 1
1,990,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	62 — 64	61 — 63	61½	..	—1	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	83 — 85	81 — 83	..	..	—2	4 16 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	44	..	..	5 11 1
1,200,000	City and South London Railway	Stock	13⅓%	2½%	3½%	1½%	51 — 52	31½ — 32½	32⅜	31½	+ ½	6 12 4
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	5 %	5 %	5 %	½ — 1	½ — 1	..	..	..	15 0 0
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1906.	1907.	1908.	Closing Quotations Aug. 10th.	Closing Quotations Aug. 17th.	Business done week ended Aug. 17th. 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1/3 — 1/3	1/3 — 1/3	..	..	..	8 0 0
806,000	Do, do. 6 % Cum. Pref., 1 to 806,000 ..	1	6 %	6 %	6 %	6 %	1/3 — 1/3	1/3 — 1/3	24/3	..	..	4 16 0
271,030	Do, do, 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½%	4½%	2½%	1½%	3/8 — 7/16	3/8 — 7/16	..	..	..	20 0 0
17,189	Do. "A" shares, 01—017,189 ..	5	4½%	4½%	2½%	2½%	1 — 1½	1 — 1½	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 1/2	7/16 — 1/2	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	7 %	1⅜ — 1 7/16	1⅜ — 1½	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	7½ — 8	7½ — 8	..	..	..	6 5 0
800,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾ — 1	¾ — 1	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10¾	10½ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord. ..	5	15%	15 %	15%	15 %	12½ — 13	12½ — 13½	13	12⅝	+ ½	5 13 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5½	5⅛ — 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½ —107½	105½ —107½	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	14½ — 15½	14½ — 15½	15 5/16	15	+ ½	6 13 4
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½	Nil	7/16 — 9/16	7/16 — 7/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
999,980	Do. do. 50,008 to 100,000	10	3 %	3 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3½%	2 — 2¾	1½ — 2⅝	45/-	..	— ⅛	15 8 4
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	68 — 71	68 — 71	69½	68½	..	5 12 8
5,782,062	Metropolitan Consolidated	100	2½%	1 %	½%	½%	40 — 40½	40 — 40½	40⅜	40	..	1 4 6
3,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	65 — 67	65 — 67	65⅞	64⅝	..	4 2 1
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	17⅛ — 17⅞	17 — 17⅞	17⅝	17⅛	— ¼	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	½%	3/16 — 5/16	3/16 — 5/16	12/6	..	— 1/16	
314,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
600,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	13/16 — 15/16	13/16 — 7/8	15/6	..	— 1/32	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	95 — 97	95 — 97	..	..	..	4 12 9
$10,832,200	Mexico Trams Co., Common Stock	..	..	..	..	..	124½ —127½	128 —131	129⅞	127½	+ 3½	
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	94½ — 96½	96 — 98	97	95	+ 1½	5 2 0
345,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	..
345,500	Do. 6 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/16 — 3/16	1/16 — 3/16	..	..	..	6 17 11
345,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34 — 35½	35½	34½	..	2 10 9
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —101½	100 —101½	..	..	..	3 18 10
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	102½ —103⅛	102⅛ —103⅛	103½	102⅝	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	88 — 90	89	..	+1	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	35 — 37	35 — 37	37	36½	..	..
66,666	Willans & Robinson, 1 to 50,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	3/16 — 7/16	3/16 — 7/16	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 126,001 to 141,666	1	Nil	..	6 %	6 %	2⅜ — 3½	2⅜ — 3½	58/9	..	..	1 18 5
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼ — 4⅜	4¼ — 4⅜	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8 — 8¼	7⅞ — 8 xd	..	..	..	6 5 0
9,151	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	7⅞ — 8 xd	7⅞	..	..	4 7 6
826,176	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 — 100	..	..	..	3 18 6
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	4 — 4½	..	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½ — 5	4½ — 5	91/10⅝	..	..	4 10 0
80,000	Do. "City Undertaking" 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 2 10
445,356	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	3 19 3
49,356	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,000	City of London Elec. Lighting, Ord. 40,001—110,696	10	6 %	6 %	6 %	6 %	10⅜ — 10⅞	10⅜ — 10⅞	10⅜	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11½ — 12½	11½ — 12½	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2⅝ — 3⅛	2⅝ — 3⅛	..	..	..	8 6 8
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	3 — 3½	3 — 3½	..	..	..	7 2 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93½ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11	10⅝ — 11	..	..	..	5 9 1
400,000	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	103 —106	103 —106	105½	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	5/16 — 7/16	5/16 — 7/16	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 — 61	58 — 61	..	..	..	7 7 7
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	84½ — 86½	84½ — 86½	87	85½	..	5 16 3
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 7 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅜ — 7⅝	7⅜ — 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds. ..	..	..	..	..	5 %	98 —101	98 —101	..	..	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	6⅝ — 7⅛	6⅝ — 6⅞	..	..	— ⅛	5 16 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	5 11 8
882,255	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
800,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅜ — 4⅝	4⅜ — 4⅝	87/6	..	..	5 5 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	..	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000	Do. 3½ % Mort. Deben. Stock Redeem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80 — 85	83½ — 84½	84½	..	..	5 17 8
13,685,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	2½%	70 — 74	72 — 76	76	72	+2	4 12 1
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	105 —104	106 —110	106½	..	+1	6 7 3
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	85 — 87	86 — 88	87½	87	+1	5 13 8
960,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
130,491	Newcastle-on-Tyne, 1 to 187,500	5	3 %	3 %	3 %	2½%	4⅜ — 5⅛	4 — 4½	..	..	— ⅛	2 15 7
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 0 0
196,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	..	..	..	..
10,859	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11 — 12	11 — 12	..	..	..	5 16 8
20,000	Oxford, 1 to 96 and 407 to 20,316	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
80,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elety. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1⅞ — 1 7/16	1⅞ — 1 7/16	..	..	..	5 7 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½ — 9	8½ — 9	9	..	..	7 2 10
80,000	Do. do. 7 % Pref. 20,001 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 11 10
160,000	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝ — 3	2⅝ — 3	..	..	..	6 13 4
125,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 7/16	5/16 — 7/16	..	..	..	4 8 11
142,966	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1 3/16	1⅛ — 1 3/16	..	..	..	5 6 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —104	..	..	..	4 6 7
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	¾ — 1	¾ — 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1½ — 2	1½ — 2	30/-	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	76 — 80	77 — 81	..	..	+ 1	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	4⅜ — 4⅝	4⅜ — 4⅝	17/6	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8¾ — 9½	8¾ — 9	8 1/16	8 1/16	+ ½	5 11 1
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	4⅛ — 5⅛	4⅛ — 5⅛	..	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

SOME LEGAL QUESTIONS RELATING TO ELECTRIC FITTINGS AND METERS.

[FROM OUR LEGAL CORRESPONDENT.]

It is proposed in the present article to discuss some of the questions which are often arising in relation to fittings. They may belong to the company or to the consumer, and nice legal problems occasionally arise as to the right of inspection and so forth.

Sec. 24 of the Electric Lighting Act, 1882, provides that any officer appointed by the undertakers, may at all reasonable times enter any premises to which electricity is, or has been, supplied by the undertakers, in order to inspect the electric lines, meters, accumulators, fittings, works, and apparatus, for the supply of electricity belonging to the undertakers, and for the purpose of ascertaining the quantity of electricity consumed or supplied, or where the undertakers are authorised to take away or cut off the supply of electricity from any premises, for the purpose of removing any electric lines, accumulators, fittings, works or apparatus belonging to the undertakers, repairing all damage caused by such entry, inspection, or removal. The powers conferred by this section must not, however, be arbitrarily exercised. Due notice of an intended visit should be given, for it was decided in Brompton, &c., Electricity Supply Co. *v.* Shadforth (ELECTRICAL REVIEW, July 24th, 1903), that where a consumer refused to allow inspectors to come into her house unless she received previous notice of their visit, an injunction ought not to be granted to restrain her. Electric fittings are also protected from distress for rent. Thus, by Sec. 25 of the Electric Lighting Act, 1882, where any electric lines, meters, accumulators, fittings, works, or apparatus belonging to the undertakers (*i.e.*, the local authority or company supplying electricity) are placed upon any premises for the purpose of supplying electricity, they shall be subject to protection. In the ordinary way they might be seized by a landlord whose rent was in arrear; but this section provides that they shall not be subject to distress, or to the landlord's remedy for rent of the premises where the same may be, nor be taken in execution under any process of a Court of law or equity, or any proceedings in bankruptcy against the person in whose possession the same may be. This affords considerable protection to the undertakers. Very often when a tenant does a moonlight flit the only articles of *vertu* left on the premises are the electrical fittings, which the landlord would be glad to sell in order to satisfy some part of his claim for rent outstanding.

But what are fittings within the meaning of this section? Wires, and pipes through which wires are carried, naturally come under this heading, but there are other things not so easy to classify. It was decided under Sec. 14 of the Gasworks Clauses Act, 1871, which is similar to the above, that a gas stove let for hire is a "fitting for the gas" within the meaning of that section, and is therefore not subject to distress for rent (see Gas Light and Coke Co. *v.* Hardy, 1886, 17 Q.B.D., 619). It would seem to follow from this that electric stoves, kettles, motors, fans and electric irons, if hired out by the supply authority to the consumer, would not be subject to distress by the landlord.

A nice question may sometimes arise as to whether electric fittings let on hire by the supply authority vest in the trustee in bankruptcy of the consumer. The law of bankruptcy provides that goods which are in the order and disposition of the bankrupt, with the consent of the true owner at the date of his bankruptcy, shall vest in the trustee for the benefit of the creditors. And this is right; for credit is naturally given to a man upon the strength of the goods which he has on his premises. But where it is well known that certain classes of goods are customarily lent on hire, the presumption that they belong to the bankrupt does not arise. For instance, the custom of hotel keepers to hire furniture is so well known that such furniture does not vest in the trustees in bankruptcy of the hotel proprietor. It has long been the practice of the gas companies to hire out gas stoves to consumers; and questions arise from time to time as to the power of local authorities supplying electricity to deal in fittings. It is common to find in the Acts of local authorities a special clause enabling them to sell, hire, let, but not to manufacture lamps, meters, electric fittings, &c. The terms of such clauses vary somewhat. In the Nottingham Corporation Act, 1899, Sec. 4, the power conferred is to provide and let, &c., but not manufacture, "lamps, meters, electric lines, fittings, apparatus and things for lighting and motive purposes for which electric energy can or may be used, or otherwise necessary or proper for the supply, distribution, consumption or use of electrical energy." The Manchester Corporation (General Powers) Act, 1898, after the usual wide powers, contains these words: "Electrical motors and apparatus for the use of electricity for motive power and other purposes." The Halifax Corporation Act, 1898, is even wider in its terms. It authorises the Corporation "to purchase, hire, sell, let on hire, or otherwise deal with dynamos, electric motors, accumulators, meters, burners, arc and other lamps, fittings, wires, plant, engines, conductors, machinery, apparatus and appliances for and in relation to the production, supply, distribution or utilisation of electricity, or required or used for or in connection with their electrical works and undertaking. . . ."

The case of the Attorney-General *v.* the Mayor, &c., of Barnstaple (ELEC. REV., Vol. 52, p. 766) showed clearly that it is not competent for an electrical company supplying electric light to supply electric fittings without an express provision to that effect in the Act under which they work. It appeared that in 1900 the defendant Corporation obtained from the Board of Trade a provisional order. In the summer of 1902 they circularised the ratepayers, and gave out that they were prepared to supply electric fittings, and fit them up in private houses. Two ratepayers moved the Attorney-General to bring an action, and as a result of the litigation, the Corporation consented to the following order: "The Corporation undertake not to do any further installations for customers, or to expend any further moneys on private installations except in pursuance of obligations already entered into."

The question whether a tenant for life has power to lay down and charge out of capital for electric plant put in by him has been considered in many cases. In *re* Lord Leconfield's Settled Estates, which was heard by Mr. Justice Kekewich some years ago, a summons was taken out under the Settled Lands Acts by the tenant for life in possession of the certain settled estates in England, asking that the trust might be directed to apply certain capital money in their hands in recouping the applicant the following sums expended by him out of his own moneys: — (1) £4,891 19s. 7d. for the construction of a new drainage system for the principal mansion house; (2) £3,299 9s. 10d. for the erection of an engine house for the engines which supplied the principal mansion house with electric light. The Settled Lands Act, 1882, Sec. 25, provides that improvements authorised by the Act to be made with capital trust moneys are works for (Sub-Sec. (1)) drainage, and (Sub-Sec. (2)) saw mills, scutch mills and other mills, waterwheels, engine houses and kilns, which will increase the value of the settled land for agricultural purposes, or as woodland or otherwise. It was held that, assuming that the engine house would increase the value of the settled land, taking settled land to include the principal mansion house, yet it would not increase its value "for agricultural purposes or as woodland or otherwise" within the meaning of Sub-Sec. 12, and that its expense could not therefore be allowed out of capital moneys; but it was held also that the cost of the new drainage system could be allowed, for it was not a case of mere addition but a completely new system and a permanent improvement. This decision appears to be somewhat incomprehensible to the non-legal mind. The tenant for life was allowed to spend a considerable sum of money on the drains for the house, but was not permitted to put down an electric lighting plant.

Yet, in the existing conditions of modern society, it is almost a *sine quâ non* that a country gentleman's house shall be properly lit. A glance at the date of the Settled Land Act is sufficient to explain this anomaly. That measure was passed in the same year as the first Public Electric Lighting Act. At that time, electricity was only in its infancy, and the fact that it has long since come to stay, and that, as a source of light, it is practically a common necessity, ought

to afford sufficient justification for an amendment of the Settled Lands Act. A short section might easily be drafted, which would give the Court power to decree that a tenant for life may spend part of his capital on electric lighting.

The point was again raised in the case of in *re* Blagrave's Settled Estates (ELECTRICAL REVIEW, Vol. 52, p. 383). Mr. Justice Joyce held (following Mr. Justice Buckley in *re* Clarke, 1902, 2 Ch., 327) that this was not an improvement which could be paid for out of capital within the meaning of the Settled Lands Act (Sec. 25). When the case came before the Court of Appeal, this decision was upheld, but Lord Justice Cozens-Hardy threw out the interesting suggestion that it would be desirable to extend the Acts so as to allow provision to be made for supplying gas or electric lighting to a mansion house. This, however, was a matter for the Legislature, not for the Court, to decide.

Under the heading Electric Fittings, the questions affecting the validity and effect of the free-wiring agreement appears to find a proper place. In the London Electric Supply Corporation, Ltd., *v.* Priddis (18 T.L.R. 64) an agreement made between the plaintiffs, the National Electric Free Wiring Co., Ltd., and the defendant on February 17th, 1898, contained (*inter alia*) the following clauses: "(2) The Wiring Co. will in a proper manner and in accordance with the regulations of the fire insurance companies, and free of cost to the consumer, furnish and fit up on the said premises the necessary wires and fittings for electric lighting, hereinafter called 'the installation.'" Clause 4 gave the defendant an option of purchase in a certain event. Clause 7 provided: "The consumer shall until purchase as aforesaid pay quarterly to the supply company for the use of the installation ¾d. per Board of Trade unit for every unit of electrical energy supplied to the said premises, and the *minimum* payment in any year shall be 1s. for each 8-C.P. lamp or its equivalent installed." Clause 8 contained a proviso for recovery in case of non-payment. The defendant used no electricity supplied by the plaintiffs from June to September, 1900. They sued in the County Court for the sum of £1 6s. 9d., being the *minimum* provided by Clause 7 *supra*. It was held, on appeal, that the installation had clearly been put in on the terms that the customer should have the right to purchase after five years, and that during those years he was liable to pay a *minimum* rent, whether he used the current or not. The case was sent back for a new trial.

Of all electric fittings to be found on the consumer's premises, the meter, which is usually hired out to him by the company, is likely to be productive of the greatest amount of trouble.

The register of a gas meter is *primâ facie* evidence of the quantity consumed, and two justices are empowered to settle differences between the company and the consumer. (See 34 and 35 Vict., C. 41, Sec. 23.) In the case of the Gas Light and Coke Co. *v.* Cree, 1897, 61 J.P. 699, it was laid down that where the only evidence of the amount is afforded by the meter, the Court will be unwilling to go behind it. There is no reported case in which a complainant has challenged the accuracy of a meter by appealing to an independent authority.

In the case of electricity supply, the meter register is still more conclusive. If any difference arises between any consumer and the undertakers as to whether any meter, whereby the value of the supply is ascertained (whether belonging to the consumer or to the undertakers), is, or is not, in proper order for correctly registering the value, or as to whether the value has been correctly registered by the meter, that difference is to be determined upon the application of either party by an electric inspector, or, where the local authority are the consumers, by an inspector appointed by the Board of Trade. The inspector has jurisdiction over the costs of the inquiry, and his finding is conclusive and binding on the parties. Subject to the inquiry, the register of an electric meter is conclusive evidence of the value of the supply in the absence of fraud. (Electric Lighting (Clauses) Act, 1899, Sec. 57.)

As to the finality of the decision of a Government inspector, it is worthy of note that in the case of the Wandsworth and Putney Gas Co. *v.* Rye (31 Sol. J. 633) the accuracy of a gas meter, sworn to be perfectly accurate by a Government inspector, was successfully disputed, not by the production of any expert evidence, but merely by the sworn testimony of the plaintiff and his servants, who deposed that less gas had been used in the quarter immediately preceding that for which the company sought to charge. The authority of this decision, which comes from an inferior court, is doubtful.

Should the methods of supply and charge be altered, undertakers are bound to defray the expense of providing new meters to their consumers (Electric Lighting (Clauses) Act, 1899, Sec. 58.) It sometimes happens that a serious defect in a meter remains undiscovered over a long period of time. The consequence is that a consumer may be overcharged or—as more rarely happens—considerably undercharged for the amount of gas or other commodity consumed by him. In such circumstances there is authority for saying that, in so far as any claim is not barred by the Statute of Limitation (which prevents a debt being recovered after a lapse of six years) the injured party is entitled to redress. In the case of the South Metropolitan Gas Co. *v.* the Mayor, &c., of Bermondsey (the *Times*, May 18th, 1901), an action was brought to recover the sum of £884, the price of gas supplied to the Commissioners of Baths and Wash-houses in Rotherhithe (the predecessors of the defendants), from 1894 to 1900. Owing to the fact that the dial of the meter in use during that period was misleading, the amount of gas charged for was but one-tenth of the actual amount consumed. The mistake had existed since 1885, but the claim for arrears which had accrued prior to 1894, was barred by the Statute of Limitations. The defendants admitted the mistake, but sought to escape liability on the ground (*inter alia*) that they could not make or levy a retrospective rate for the purpose of discharging the debt, nor could they apply the moneys in their hands derived from current rates in payment thereof. This defence, however, did not prevail, and they were held liable for the arrears which were not barred by the statute.

A meter belonging to the undertakers which is placed upon any premises not being in the possession of the undertakers for the purpose of supplying electricity is not subject to distress for rent; that is to say, the consumer's landlord could not distrain upon it. The same rule applies to "electric lines, accumulators, and fittings" (Electric Lighting Act, 1882, Sec. 25). "Fittings," as applied to the property of a gas company, have been held to include a gas stove (Gas Light and Coke Co. *v.* Hardy, 17 Q.B.D. 619). An electric stove or an electric motor would probably come under the same heading, and would, therefore, be protected.

REVIEWS.

Heavy Electrical Engineering. By H. M. HOBART, M.Inst.C.E. M.I.E.E. London: Constable & Co. Price 16s. net.

This is probably the best book on electrical engineering considered in its broadest aspect that has been published. It is the work of a man of wide experience and reading, accustomed to minute observation and accuracy of statement.

Not only are the 300 odd pages full of valuable information, but the sequence of the facts and data is very well arranged. There are none of those irritating gaps in the general argument, met with in some text-books. Tables and curves run up to No. XCVIII and fig. 188 respectively, and they are not flung at the reader in pocket-book fashion, but are marshalled in correct order, giving just the information necessary to make each link in the chain of argument quite clear. The book treats of the more difficult problems of electrical engineering, and yet the mathematics used are quite simple; in only one instance, and that a quotation from Jona's graded cable paper, is there a reference to the calculus.

As with other books by the same author, the whole of the measurements and quantities, &c., are given in the metric system. Feet and inches, pounds avoirdupois, gallons, &c., are rigidly excluded.

A very useful feature is the way in which every calculation is resolved into the electrical engineer's unit of energy—namely, the kilowatt-hour or "kelvin." It seems odd at

first to think of problems in connection with economisers, condensers, steam piping, boilers, &c., in kilowatt or kilowatt-hour units, but there can be no question of the convenience of the method.

The mechanical engineer whose work does not bring him into touch with electrical matters, will find in this book much up-to-date information on purely mechanical appliances. The reason is, that in laying out large power stations, such as those of Glasgow, the Central London, Brimsdown, Neasden, Greenwich, Chelsea, &c., the electrical engineers have had opportunities of working out some big mechanical engineering problems.

The first six chapters familiarise the reader with results that can be obtained from the pieces of apparatus that make up a power station, and Chapter VII explains how to combine them for efficient service.

Then follows a most interesting section on high-tension power transmission, and the last two chapters, covering nearly 100 pages, treat of electric traction calculations, traction motors and the electrification of railways.

The illustrations are exceptionally clear, the curves are fully described by their titles, and where necessary a series of curves are given on one sheet, instead of having one curve sheet with a number of lines jumbled together.

Mr. Hobart is an international engineer, his experience having been gained in the United States and Germany, as well as in this country. Therefore, when quoting statistics he takes data from all countries. Some of his percentages for power stations, &c., may be here quoted :—

AVERAGE OVERALL EFFICIENCIES OF STATIONS.

Between 1·0 and 5·1 millions of KW.-hours per year.	Great Britain	4·9 %
	Abroad	6·0 %
Between 18 and 56 millions of KW.-hours per year.	Great Britain	7·7 %
	Abroad	9·0 %

AVERAGE TRANSMISSION LOSSES.

	In 12 Continental stations.	In 5 Continental stations.
Loss in feeders	12 %	3 %
„ accumulators	7 %	3 %
„ transformers	—	17 %
„ distributors	6 %	8 %
	25 %	31 %

In 22 large towns of Great Britain, for every 1,000 inhabitants there are 800 8-C.P. lamps, or their equivalent, connected, and the average KW.-hours per lamp per year work out at 17 at the customers' meters.

The demand for electricity in 26 Continental power stations is 15 KW.-hours per inhabitant.

Averaging the tramway returns for 17 cities in England, gives 18·4 car-kilometres per inhabitant, and a consumption of 0·87 KW.-hour per car-kilometre.

When dealing with electric generating plant, Mr. Hobart forecasts the dimensions of a 20,000-KW., 20,000-volt, 25-cycle, 250 R.P.M., three-phase alternator, and as he is such a well-known and bold designer, particulars may be of interest. It will have 12 poles, a rotor diameter of 4 metres and length of 2 metres. The length over the stator windings will amount to some 3 metres, and the external diameter over stator windings to 5 metres. This alternator will require 15 tons of copper, 135 tons of electro-magnetically effective iron and 150 tons of materials for the mechanical parts. This aggregates 350 tons, or 17·5 kg. per kilowatt of rated output.

He writes vigorously regarding an inspector's duties, and referring to the importance of insulation testing, says, "The studied attempt on the part of large manufacturers and their subservient engineers to discredit the practice of subjecting machines to high-voltage insulation tests, and to substitute low factors of safety in specifications to which they tender, should not be permitted to succeed."

Some contractors are inclined to browbeat any inspecting engineer who acts right up to his client's interests, and they will go to any length to render untenable the position of a conscientious inspecting engineer. The writer can subscribe to this in regard to one firm in this country, and the explanation is partly found in Mr. Hobart's next sentence, "Thus the contractor may be an influential shareholder in the company for whom the client is acting, or the client in some other capacity may be dependent upon the contractor for a considerable proportion of the business turned over to him in this other capacity." Such relations are far from rare, and where they exist the business is a farce, so far as relates to specifications and tests.

The author's idea of a short-circuit test of an alternator is to adjust the field excitation to give normal voltage and then abruptly short-circuit the terminals of the three windings. For an instant a current several times (often six times the normal) will pass, but this will rapidly decrease to about three times, and remain constant at that. If the stator end connections have not moved after such a test, the machines can be relied on to sustain no mechanical injury as a result of short circuits on the line. It would also ensure against injury when thrown into circuit with other machines when its own phase differed from the other, as inevitably occurs at times.

Mr. Hobart favours a low periodicity, especially for low-speed gas engine sets. He points out that the slow-running gas engine requires great fly-wheel capacity to ensure parallel running, also there is a loss of several per cent., because amortisseurs have to be fixed on the alternator poles. He considers that the difficulty can be largely overcome by adopting a low periodicity. Whilst it possesses no special disadvantages, it leads to a better design of generator with fewer poles and higher efficiency, also to better conditions in the transmission line and at the sub-station. He says "the persistency in refraining from low periodicities when justified by circumstances such as the parallel operation of polyphase generators from gas engines, and even from large slow-speed steam engines, is really a remarkable phenomenon in modern electrical engineering, but there are at length signs of a more satisfactory attitude on this question."

Dealing with the question of sub-station machinery, Mr. Hobart makes a point in favour of motor-generators against rotary converters, by noting that the latter require more copper in the mains. Synchronous motor-generators will carry high overloads at much less than normal voltage. In the rotary converter, the commutator voltages cannot be maintained high when the drop in the transmission line is great, nor can freedom from "surging" or "hunting" then be ensured.

Mr. Hobart is refreshingly outspoken throughout the book, and is especially severe on those who, he says, have not the remotest approach to broad knowledge, or the energy to exercise their own reasoning faculties. "Such are hardly more than figure-heads desirous, on the one hand, of being on the side of the most fashionable engineering fads, so soon as there is no longer any doubt of its being fashionable, and on the other hand, hesitating to depart from the cut-and-dried practice of years' standing, which makes the preparation of plans a mere matter of copying."

Again, dealing with what he calls "forced ideas": the natural idea may be likened to a plant growing under favourable conditions and adapting itself to its environment; the "forced idea" may be likened to a plant raised in a hot-house with the exclusion of such conditions as might have a tendency to prevent its development. He cites the single-phase railway system and extra high-pressure continuous current transmissions as "forced ideas."

Mr. Hobart shows that for equal weight and equal speed the single-phase motor has only about half the power of a continuous-current or three-phase motor, and that of the three, the last-named gives the greatest power for a given weight. The accessory apparatus for single-phase also weighs much more, and together they necessitate heavier trucks and brake gear and greater maintenance charges, &c.

He makes references to the L.B. and S.C. Railway electrification which are not complimentary, and says that it is costing at least 50 per cent. more than would have been the case if the continuous-current system had been adopted. The operating costs will also much exceed what could have been attained with continuous current. He gives many figures to prove his contentions, and the *single-phase monstrosity*, as he calls it, in heavy leaded type, is smitten hip and thigh, through about 50 pages.

The author considers that for long-distance non-stop runs the steam locomotive will hold the field for a long time to come, but that there is a wide field for the electrification of urban, suburban and inter-urban sections. He says: "It is highly desirable that railway people should realise that a

larger number of electrical engineers dissociate themselves, though rarely openly, from the claims put forward by the single-phase school. This is important, for the reason that there is a wide range of railway work when electric operation is of demonstratable advantage if undertaken on sound lines."

Regarding the three-phase system, he says: "It must also be kept in mind that the three-phase system can by no means be ignored as a determinant on the situation; in fact, for long-distance, non-stop runs it has points of superiority over any other system of electric traction as yet put forward. But at present it is with the object of obtaining better speed and shorter headway with frequent stops, and the more intense utilisation of termini, that resort will be made to electrical methods." E.K.S.

Radio-telegraphy. By C. C. F. Monckton. London: Archibald Constable & Co. Price 6s.

It is not to be expected in the present limited state of exact knowledge of radio-telegraphy in its various aspects that any text-book on the subject will fully elucidate such problems as are involved in ranges of communication between various types of stations, conditions of interference and non-interference, relative efficiencies of the various methods of transmitting and receiving or of the different types of antennæ and a host of other questions of much practical importance. Precise measurements bearing on these points are much wanted. Hence such information of real practical utility as can, at present, be recorded, merely serves to emphasise the dearth of real engineering data in many diverse directions. So much attention has been given to the development of new systems, new methods of transmitting and receiving and to the extension of distances of communication, that systematic measurement has, to a large extent, been neglected, or, at any rate, is yet unpublished. In the work under review there has been a serious attempt to bring out all that is available in the way of useful practical information. Hence the book is one of the most practical expositions on wireless telegraphy that has yet been produced, and will give to the engineer some at least of that practical guidance which is usually looked for in vain. The matter contained is, in the main, reliable and well ordered, though it is perhaps unavoidable that many of the statements made are open to difference of opinion, if not to criticism. The opening chapters deal with general principles; electrostatics, electromagnetism, and electric wave production. A good method of explanation has been attempted, but the rendering is somewhat involved, and likely to be difficult of appreciation by the student. Referring to wave propagation, the author makes a point of the tendency of waves to be tilted forward in the direction in which they are travelling by reason of the retardation of the lower portions associated with the surface of the ground. This is in contrast with generally accepted ideas in which the assumed tendency is rather a backward tilt due to the action partaking of the characteristics of an expanding hemisphere, and it will require stronger reasons than those given on pages 66 and 67 to make the author's view convincing. Dealing with the propagation of waves from the point of view of expanding fields of force, there appears to be a lack of finish in the method adopted on page 68. It would appear that the student is to picture a succession of magnetic fields of constant density passing a fixed point. The omission is that it is not brought home to him that the number of lines of force per wave (*i.e.*, the density of field) must diminish as the wave expands, otherwise the wave would gain energy as it progressed. The point is not a very important one, but it is one of those details which are always omitted in this method of picturing wave propagation and which tend to detract from the value of an otherwise correct and useful conception. On page 65 appears a repetition of the fallacy that rarefied air is a good electrical conductor. Rarefied gases do not conduct unless they are ionised or the electrical stress exceeds a certain critical value. On page 54 the author stumbles against a much misunderstood aspect of wave propagation—viz., the question of phase displacement of the electric and magnetic fields in the wave proper. It does not appear to have appealed to most writers on the subject that there is an essential difference between oscillations and waves, and that in a wave proper no phase difference is possible, otherwise the various points of disturbance would continue to oscillate after the passage of the wave.

On the whole, however, there is much to be commended, and little to criticise seriously in this work.

THE MEASUREMENT OF THE INSULATION RESISTANCE OF A LIVE THREE-WIRE SYSTEM.*

By Dr. GISBERT KAPP and Dr. DENNIS COALES.

The well-known Russell test gives the combined insulation resistance of the three wires, but not that of each wire separately. It, moreover, necessitates interrupting the earthing connection whilst the test is being made. This is not necessary in Froehlich's modification, but Froehlich's method, however, also does not allow of a separation of the joint conductivity of the three faults into its three components. In the present communication we propose to describe a method whereby this separation can be made, but before entering into this subject we shall describe two methods for finding the joint fault resistance, which do not require the earthing connection of the middle wire to be broken. The joint conductivity found by either method includes that of the earth connection, but as this is generally known, or can be ascertained at any moment by reading the earthing ammeter and the voltage to earth of the middle wire, the necessary correction to get the true fault resistance of the system can easily be made; but the accuracy of the determination is marred by the presence of a low earthing resistance, and this should, therefore, be temporarily increased to a limit determined by the permissible voltage between the neutral wire and earth.

1. *Method.*—Let in fig. 1 *a b* represent a potential slide, the resistance of which need not be known. The ends are permanently connected to the outer wires 1, 2, and the slider is connected through an ammeter A to earth. The middle wire is connected through a voltmeter V of resistance ρ to earth. E is the usual earthing connection with its ammeter A_0. To measure the total fault resistance push the slider into such a position that A reads

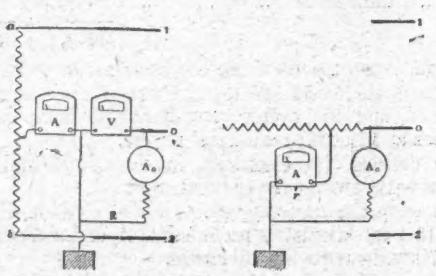


Fig. 1.

Fig. 2.

zero, and note the reading of V, which we shall call e. Then push the slider into such a position that V reads zero, and note the reading on A, which we shall call i. The fault resistance is then—

$$f = \frac{e}{i - e/\rho}. \qquad (1)$$

2. *Method.*—The middle wire has besides its usual earth connection, a connection with a graduated resistance with sliding contact, and the latter is connected to earth through a low-reading ammeter (fig. 2). To make a test, set the slider so that the pointer of the ammeter reads a little under half its total range, and note the corresponding resistance in circuit between the slider and middle wire. Let this be ρ and the current i. Then shift the slider so as to reduce the resistance to such a value ρ_1 that the current is exactly doubled. This will bring the pointer to near the end of the scale. Thus both currents can be read with great accuracy. If r is the resistance of the ammeter the combined fault resistance is—

$$f = \rho - 2\rho_1 - r. \qquad (2)$$

These methods have the advantages of being very simple and requiring no complicated calculation, that they do not interfere with the earthing connection, and that they can be applied at any point of the system—for instance, in the engineer's office instead of at the switchboard, as is necessary with the Russell test.

Since all the methods for finding the fault conductivity proposed up to the present give the sum of the conductivities, it is obviously hopeless to try separating them by the use of additional artificial faults. We must introduce a new element into the test, and this is a slight variation of the difference of voltage between the two sides

* Abstract of original communication to the *Journal* of the Institution of Electrical Engineers.

of the system. This may be done, since the Board of Trade allows a variation of ± 4 per cent. in the pressure on the consumer's premises; and if the test be made at a time of minimum load, this means also 4 per cent. variation of bus-bar voltage at the station. Thus if normally the consumer's voltage is 250 on each half of the system, it will be permissible to adjust by means of the regulating cells or the balancing set the voltage to 240 on the positive and 260 on the negative side, and then change the difference so as to get 260 on the positive and 240 on the negative. We obtain thus a change of 20 volts in the value of E_1 and E_2, and some change in the value of e. By observing these changes we are able to determine the fault conductivities separately, as shall now be shown.

Fig. 3 represents the apparatus we use for the purpose. The outer wires are connected to the terminals 1, 2, and the middle wire is connected to o. V is a voltmeter capable of reading the pressure between the two outer wires. It is provided with a switch so that it may also be used to measure the pressure between one

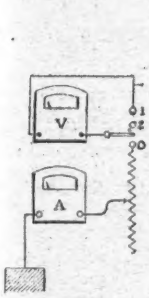


Fig. 3.

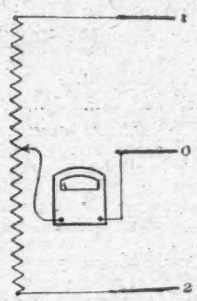


Fig. 4.

outer (say the wire 1) and the middle wire. A is the low-reading ammeter used in connection with the test according to method 2 described above, and ρ is its series resistance. This is not altered during the test. The pressure between the two outer wires is also kept constant, but E_1 and E_2 are varied so that $E = E_1 + E_2 = E_1' + E_2'$; $E_1' - E_1 = E_2 - E_2'$ being the permissible variation of about 8 per cent. of the declared pressure. Let K be the combined conductivity of the three faults and the ammeter with its series resistance. Let E_1 and E_2 be the voltages to middle wire of the two outers and e that of the middle wire to earth. Let the fault resistances be f_1, f_2 and f_0 respectively, the latter including the earthing resistance. Let the conductivities be c_1, c_2 and c_0.

$$E_1 c_1 - E_2 c_2 + e K = 0 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

$$E_1' c_1 - E_2' c_2 + e' K = 0 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

$$(E_1' - E_1) c_1 + (E_2 - E_2') c_2 + (e' - e) K = 0$$

$$(E_1' - E_1) c_1 + (E_1' - E_1) c_2 + (e' - e) K = 0 \quad . \quad . \quad (5)$$

$$c_1 + c_2 = \frac{e - e'}{E_1' - E_1} K.$$

Since $c = c_1 + c_2 + c_0$ is known from the test made according to method (2), we find the conductivity of the fault on the middle wire from its conductivity—

$$c_0 = c - K \frac{e - e'}{E_1' - E_1} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

To get the other two conductivities we proceed as follows:—

Determine c_2 from equation (5) and insert in (3); this gives—

$$c_1 = K \left(\frac{E_2}{E} \frac{e - e'}{E_1' - E_1} - \frac{e}{E} \right) \quad . \quad . \quad . \quad . \quad . \quad (7)$$

Determine c_1 from equation (5) and insert in (3); this gives—

$$c_2 = K \left(\frac{E_1}{E} \frac{e - e'}{E_1' - E_1} + \frac{e}{E} \right) \quad . \quad . \quad . \quad . \quad . \quad (8)$$

This test also need not be made at the switchboard, but can be made at any point on the system. The two instruments may be fitted up in the engineer's office, and all that is required is to give the switchman instructions to shift the voltage between middle wire and outers by a slight amount. It is not necessary that the difference should be exactly 4 per cent., anything between 3 and 4 per cent. is sufficient for an accurate test, but it is important that the voltage over the outer wires should be unaltered during the few minutes required for the test.

On consideration of the formulæ Nos. (7) and (8), it will be observed that the values of the fault conductivities of the outer mains depend for their accuracy upon the determination of the small differences between the large voltages E_1' and E_1. To render this measurement sensitive, two methods may be employed; (*a*) in which a voltmeter having an initial spring tension, and, say, of 10,000 ohms resistance, reading from 230 to 270 volts, is used; (*b*) in which a low-reading voltmeter is connected to a sliding contact (see fig. 4) on a slide wire connected to the outer mains, the other terminal of the voltmeter being connected to the middle wire.

Both these methods may be extended to the measurement of the voltage between the middle wire and earth upon the same instrument. When the insulation of the outer mains is high compared with that of the neutral main, and especially when the earthing resistance is low, the value of $(e - e')$ is very small compared with e. That is to say, a given change $(E_1' - E)$ in the mains voltages produces a small change on the voltmeter reading between the neutral and earth, and therefore for this reading also a voltmeter with initial spring tension is desirable.

By means of varying the series resistance of such a voltmeter, we can in the usual way change the value of its readings as we like, and so one voltmeter may be used to measure sensitively both $E_1' - E_1$ and $e - e'$.

If, for example, with total resistance of 10,000 ohms a voltmeter reads from 230 to 270 volts, then by altering this to 100 ohms it will read from 2·3 to 2·7 volts. Such an instrument should be provided with a rheostat having two sliders, two rows of contacts, and two keys, as in the diagram (fig. 5), each contact being marked with the volts per division on the voltmeter. The resistances between the contacts should be chosen so as to enable all voltages to be measured between, say, 90 and 120, 190 and 230, 240 and 260 on the upper row; and between 0·2 and 15 on the lower row. R V is a reversing switch, K_1 and K_2 are keys connecting the voltmeter to the outer wires and earth respectively.

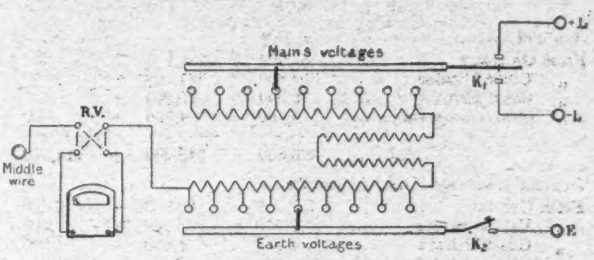


Fig. 5.

The instrument represented in fig. 5 may also be used to make the test of the combined fault by the methods given above, provided that the value of one scale division in amperes is known. We thus have an instrument which enables the fault resistances of each of the three live mains of a three-wire system to be determined.

TRADE STATISTICS OF MEXICO FOR 1907-8.

The following statement of the imports of electrical and other materials into Mexico during the year ended June 30th, 1908, is taken from the recently issued annual trade statistics; figures for 1906-7 have been added for purposes of comparison, and notes of any increases or decreases are given:—

Peso = 4s.

	1906-7. Pesos.	1907-8. Pesos.	Increase or decrease. Pesos.
Copper, brass, bronze, &c., wire, covered with various materials.—			
From Germany	124,800	186,700 +	61,900
„ Austria	7,100	8,200 +	1,100
„ United States ...	461,900	641,600 +	179,700
„ Great Britain ...	1,800	2,300 +	500
„ Other countries ...	1,100	1,900 +	800
Total ...	596,700	840,700 +	244,000
Bare copper, brass, bronze, &c., wire, up to 2 mm. diameter.—			
From Germany	9,400	12,100 +	2,700
„ United States ...	6,200	8,700 +	2,500
„ Great Britain ...	3,400	2,800 —	600
„ Other countries ...	1,000	2,500 +	1,500
Total ...	20,000	26,100 +	6,100
Bare bronze, copper, brass, &c., wire, more than 2 mm. diameter.—			
From Germany	27,100	169,900 +	142,800
„ United States ...	213,900	336,300 +	122,400
„ Great Britain ...	1,600	1,400 —	200
„ Other countries ...	400	300 —	100
Total ...	243,000	507,900 +	264,900
Cables, not armoured, of copper, brass, &c., covered with various materials, and bare cable.—			
From Germany	35,900	44,500 +	8,600
„ United States ...	752,400	450,400 —	302,000
„ Great Britain ...	34,900	86,900 +	52,000
„ Other countries ...	5,100	2,700 —	2,400
Total ...	828,300	584,500 —	243,800
Cables, armoured, covered with various insulating substances.—			
From Germany	182,700	81,700 —	101,000
„ United States ...	53,400	125,900 +	72,500
„ Great Britain ...	58,000	62,600 +	4,600
„ Other countries ...	5,300	2,100 —	3,200
Total ...	299,400	272,300 —	27,100

	1906-7. Pesos.	1907-8. Pesos.	Increase or decrease. Pesos.
Lead tubing, sheets, &c.—			
From Germany	14,900	5,100 —	9,800
„ United States ...	63,900	45,700 —	18,200
„ France	1,500	12,200 +	10,700
„ Great Britain ...	2,900	7,700 +	4,800
„ Other countries ...	700	800 +	100
Total ...	83,900	71,500 —	12,400
Iron and steel wire more than 1 mm. dia —			
From Germany	57,000	234,900 +	177,900
„ United States ...	358,900	387,500 +	28,600
„ Great Britain ...	8,500	15,900 +	7,400
„ Other countries ...	4,400	4,900 +	500
Total ...	428,800	643,200 +	214,400
Iron and steel wire 1 mm. dia or less.—			
From Germany	17,500	23,900 +	6,400
„ United States ...	49,500	45,300 —	4,200
„ Great Britain ...	4,400	5,600 +	1,200
„ Other countries ...	500	2,400 +	1,900
Total ...	71,900	77,200 +	5,300
Posts, cross-pieces, &c., of iron or steel, for transmission of electricity.—			
From Germany	45,700	120,000 +	74,300
„ United States ...	254,900	307,100 +	52,200
„ Great Britain ...	39,800	53,100 +	13,300
„ Other countries ...	3,000	10,900 +	7,900
Total ...	343,400	491,100 +	147,700
Rails and parts thereof, for railways.—			
From Germany	822,200	884,300 +	62,100
„ Belgium	308,900	403,500 +	94,600
„ Spain	234,500	226,500 —	8,000
„ United States ...	2,988,900	3,810,300 +	821,400
„ Great Britain ...	291,900	926,100 +	634,200
„ Russia	—	722,800 +	722,800
„ Other countries ...	8,800	35,300 +	26,500
Total ...	4,655,200	7,008,800 +	2,353,600
Wire, of iron or steel, covered with cotton, linen, silk and paper.—			
From Germany	800	800	—
„ United States ...	1,500	1,600 +	100
„ France	1,400	2,400 +	1,000
„ Great Britain ...	100	100	—
„ Other countries ...	—	100 +	100
Total ...	3,800	5,000 +	1,200
Coal.—			
From Germany	63,500	87,300 +	23,800
„ Australia	65,000	323,600 +	258,600
„ Canada	46,000	148,800 +	102,800
„ United States ...	5,167,400	4,299,000 —	868,400
„ France	154,700	— —	154,700
„ Great Britain ...	1,089,300	2,080,900 +	991,600
„ Japan... ...	82,600	13,000 —	69,600
„ Other countries ...	11,600	300 —	11,300
Total ...	6,680,100	6,952,900 +	272,800
Graphite.—			
From Germany	700	800 +	100
„ United States ...	12,300	14,300 +	2,000
„ Great Britain ...	1,100	1,300 +	200
„ Other countries ...	600	900 +	300
Total ...	14,700	17,300 +	2,600
Scientific instruments and apparatus.—			
From Germany	86,100	112,100 +	26,000
„ United States ...	190,900	169,800 —	21,100
„ France	76,500	84,500 +	8,000
„ Great Britain ...	8,000	13,000 +	5,000
„ Other countries ...	8,100	10,800 +	2,700
Total ...	369,600	390,200 +	20,600
Arc lamps.—			
From Germany	31,900	43,900 +	12,000
„ United States ...	47,900	69,000 +	21,100
„ France	3,300	1,300 —	2,000
„ Great Britain ...	100	400 +	300
„ Other countries ...	900	300 —	600
Total ...	84,100	114,900 —	30,800
Cars and carriages for railways.—			
From Germany	37,200	27,800 —	9,400
„ United States ...	4,412,500	3,255,100 —	1,157,400
„ Great Britain ...	17,300	197,100 +	179,800
„ Other countries ...	16,100	5,100 —	11,000
Total ...	4,483,100	3,485,100 —	998,000

	1906-7. Pesos.	1907-8. Pesos.	Increase or decrease. Pesos.
Machines of all kinds for agriculture, mining, industries, &c, not specially mentioned.—			
From Germany	2,248,800	2,903,700 +	654,900
„ Austria	1,000	35,300 +	34,300
„ Belgium	56,800	91,200 +	34,400
„ Canada	4,600	10,100 +	5,500
„ Spain	118,100	89,500 —	28,600
„ United States ...	20,140,600	19,147,500 —	993,100
„ France	484,300	558,800 +	74,500
„ Great Britain ...	2,884,100	3,669,800 +	785,700
„ Holland	500	7,100 +	6,600
„ Italy	49,800	10,500 —	39,300
„ Norway	20,400	6,700 —	13,700
„ Sweden	86,300	81,300 —	5,000
„ Switzerland	159,600	236,800 +	77,100
„ Other countries ...	5,700	1,700 —	4,000
Total ...	26,260,600	26,850,000 +	589,400
Detonators of all kinds.—			
From Germany	85,700	82,300 —	3,400
„ United States ...	94,600	47,200 —	47,400
„ Great Britain ...	2,400	200 —	2,200
„ Other countries ...	2,300	7,900 +	5,600
Total ...	185,000	137,600 —	47,400
Fuses for mines.—			
From Germany	47,100	40,600 —	6,500
„ United States ...	203,100	126,800 —	76,300
„ Great Britain ...	74,300	66,000 —	8,300
„ Other countries ...	12,700	100 —	12,600
Total ...	337,200	233,500 —	103,700
Mineral tar and asphalt.—			
From Germany	5,000	15,600 +	10,600
„ United States ...	133,600	89,600 —	44,000
„ Great Britain ...	10,300	5,600 —	4,700
„ Other countries ...	13,800	12,300 —	1,500
Total ...	162,700	123,100 —	39,600
Insulators of glass, porcelain, &c.—			
From Germany	31,600	49,700 +	18,100
„ United States ...	136,800	80,700 —	56,100
„ Great Britain ...	800	2,000 +	1,200
„ Other Countries ...	5,100	4,700 —	400
Total ...	174,300	137,100 —	37,200
Sulphuric acid.—			
From United States ...	63,900	77,000 +	13,100
„ Great Britain ...	100	8,700 +	8,600
„ Other countries ...	300	700 +	400
Total ...	64,300	86,400 +	22,100
Incandescent electric light bulbs, contacts, interruptors, commutators, &c.—			
From Germany	166,500	217,900 +	51,400
„ Austria	27,700	22,600 —	5,100
„ United States ...	353,500	496,600 +	143,100
„ France	7,500	12,200 +	4,700
„ Great Britain ...	13,500	9,700 —	3,800
„ Holland	1,100	2,600 +	1,500
„ Sweden	9,200	1,400 —	7,800
„ Other countries ...	400	500 +	100
Total ...	579,400	763,500 +	184,100

POWER CHARACTERISTICS OF THE TUNGSTEN FILAMENT.*

By CHARLES P. STEINMETZ.

As in the tungsten-filament incandescent lamp the resistance increases with the temperature, the power consumption varies at a rate which is less than proportional to the square of the impressed voltage. It, therefore, was interesting to investigate experimentally the manner in which the power consumption increases with increase of voltage.

In pursuit of an extended investigation on the radiation law of the tungsten filament, a series of tests had been made with special care on a number of modern tungsten lamps, extending over a wide range of candle-powers. Taking the readings very quickly, by experts especially trained in photometric work,

* *Electrical World*, July 8th, 1909.

it was possible to reach 10 times the rated candle-power of the lamps, without any appreciable impairment or change of the filament or blackening of the globes, as evidenced by the lamp showing its original candle-power and efficiency after the test. For these data the writer is indebted to Mr. F. C. Marshall, of the Harrison Lamp Works.

Analysing the relation between the power consumption and the impressed voltage, the interesting result was found that the power consumption varies proportional to the 1·6 power of the voltage—that is, follows a law analogous to that of the hysteresis loss in iron in an alternating magnetic field, and thus can be expressed by the equation:—

$$w = c\, e^{1\cdot6}.$$

The following table gives in the first four columns some of the observed values of candle-power L, impressed voltage e, and current i of one of these lamps, a 32-C.P. 40-watt lamp. The fifth column gives the watts w, derived by multiplying volts and amperes. The values of this column can be expressed by the equation:—

$$w = 0\,0235\, e^{1\cdot6}.$$

In the sixth column of the table are given the values calculated by this equation of the 1·6 power, and in the last two columns the differences between observed values of power w and values calculated by the 1·6 power law. As will be seen, the difference in no case reaches 1 per cent.

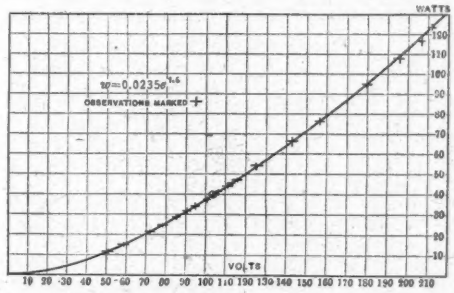
No. of test.	L C.P.	e Volts.	i Amps.	w Watts.	Watts calculated	Difference.	%
1	.. 2	49·6	·247	12·25	12·14	— ·11	— ·9
2	.. 4	59·6	·274	16·33	16·26	— ·07	— ·4
3	.. 8	70·6	·302	21·35	21·43	+ ·05	+ ·2
5	.. 13	85·3	·339	28 91	28 89	— ·02	— ·1
9	.. 32	103·3	·380	39·26	39·25	— ·01	— ·0
15	.. 64	126·6	·429	54·31	54·40	+ ·09	+ ·2
19	.. 128	157	·489	76·77	76·68	— ·59	— ·1
28	.. 256	196	·556	109 00	109·4	+ ·40	+ ·4
37	.. 320	212	·580	122·9	124·0	+ 1·10	+ ·9
28	.. 32	103·8	·380	39·45	—	—	+ ·9

In the accompanying illustration is shown the curve of 1·6 power with the observed values of power marked by crosses. As will be seen, the coincidence is so close as to give no noticeable deviation in the scale of the curve.

About 18 years ago the writer observed that the relation between the power loss in iron in an alternating magnetic field and the magnetic density can, with good approximation, be empirically expressed by a law of 1·6 power:—

$$w = \eta\, B^{1\cdot6}.$$

This law of hysteresis is still an empirical law, and all attempts to derive it rationally from theoretical considerations have thus far failed. It therefore is especially interesting to observe the



Exponential Curve, 1·6 Power.

same law of the 1·6 power, showing the relation between the consumption and voltage of tungsten lamps, especially as in the tungsten lamp the law of the 1·6 power is not only an empirical law, but can rationally be derived as a theoretical conclusion from the temperature law of metallic resistance,

$$r = a\, T,$$

and the normal radiation law,

$$R = b\, T^4,$$

where T = absolute temperature and R = total radiation power.

ELECTRICAL INSTALLATION AT SELFRIDGE'S.

The problem of lighting a large store, such as Messrs. Selfridge's, is one requiring considerable technical skill and long experience. A much higher standard of illumination is demanded by the public than is considered sufficient for ordinary buildings, and the function of the engineer is to provide an adequate amount of light, without glare, and with due regard to cost. The consulting engineers for the Selfridge installation were Messrs. Wallis-Jones & Dent, of 50, Queen Ann's Gate, S.W., and the contractors were Messrs. Malcolm & Allan, of Glasgow. For the general lighting of the principal departments 286 Westinghouse enclosed type arc lamps are used; most of the lamps have special cases, of Corinthian pillar design, finished in Pompeian green, and large diffusing opalescent globes.

The lamps are hung from the ceiling by special chains, in which the electric conductors are concealed, and are at a sufficient height to give brilliant illumination, while being well above the ordinary line of vision. In addition to the arc lamps, there are about 6,000 incandescent lamps, mostly of the metallic-filament type. These are generally carried by ornate fixtures in various styles to suit the particular scheme of decoration adopted in different parts of the building.

Electric lamps are also extensively used for lighting the glass showcases in which goods are displayed. The lamps are fitted in special trough reflectors, which wholly conceal them from view and direct the light on to the merchandise.

One of the most important features of the installation is, of course, the method of illuminating the large shop windows.

In modern high-class establishments, the use of powerful unshielded arc and incandescent lamps for this purpose is rapidly becoming extinct, and merchants are gradually coming to realise that the function of artificial light is not to illuminate the pavement outside the shop or dazzle the eyes of the would-be customer, but to display the goods so that their colour, design and other qualities may be seen to the greatest advantage. In fact, shop window lighting should be so designed that the effect produced is that of a well-lighted theatre stage. The windows at Messrs. Selfridge's are, wherever possible, lit entirely by concealed incandescent electric lamps, fixed in special adjustable mirror reflectors along the top of the window, by which the articles on show are brilliantly illuminated, while the eyes of those who are inspecting them are shielded from all glare.

Provision has also been made for illuminating the exterior of the building on special occasions, connecting boxes being fitted at various points from which temporary wires may be carried in any direction.

The installation of the electric wires has been carried out in accordance with the latest practice. Solid-drawn, heavy-gauge, screwed steel tubes are everywhere used for protecting the conductors from mechanical injury, these being placed in position during the construction of the floors, and entirely buried in concrete; special precautions were taken to protect them from corrosion. The lights are controlled from switch and fuse distribution boards in iron cases, concealed from view but easily accessible, additional local switches being fixed where needed.

Current is obtained from the continuous-current mains of the St. Marylebone Borough Council, at a pressure of 480 volts, by means of four independent feeders and seven service cables, so that the risk of interruption of the lighting and power service is reduced to a minimum. The service mains are carried to a large main switchboard in the third basement, to which 36 lighting and 20 power circuits are connected. The lighting circuits are fed at a pressure of 240 volts, and also some of the small electric motors. Large motors are supplied at 480 volts.

The building is equipped with nine Otis electric passenger lifts, designed to travel at a speed of 175 ft. per minute, and capable of each carrying 15 persons. In addition, there are two goods lifts of 5,500 lb. capacity each, and running at 150 ft. per minute. Each lift is operated by a special controller inside the car, and provision is made to enable the lift to be run at the maximum or slower speed. Signals are fitted on each landing, to indicate the approach of any lift in either direction.

There are also numerous electric motors installed for a variety of purposes, such as pumping, ventilating, air compressing, pattern cutting, ice breaking, knife cleaning, hair drying, &c.

In an establishment of this size it is of great importance to be able readily to ascertain the whereabouts of the principal members of the staff. This is accomplished by an ingenious system of signalling by four electric lamps of different colours, fixed in various parts of the building, each combination of lamps corresponding to a different person. In the telephone exchange four switches are fixed, by means of which the lamps can be lit simultaneously at every signalling point, in any desired combination. The departmental manager on seeing the lamps alight in a given combination then rings up the telephone exchange from the nearest point and is at once placed in direct communication with the inquirer.

The telephone exchange is equipped for 20 public service lines and 160 local stations, but provision is made for 60 public lines and 400 stations. Portable telephone instruments are provided in the restaurant, which may be connected to the telephone wires at 54 different points, and used at any table.

An installation of 60 electric tell-tales, to record the patrols of the night watchmen, is also provided, with portable telephones at two points for communication between an inside and outside watchman.

Electric clocks worked on the synchronome system are used throughout the building, the equipment consisting of one master clock operating 19 dials by means of half-minute impulses. The master clock is synchronised electrically with Greenwich mean time every hour. In conjunction with the clock system, a special signalling apparatus is used for ringing bells at fixed hours each day to indicate to the staff the times of beginning and leaving off work.

This brief description will afford some idea of the extent and variety of purposes for which electricity is brought into use in a modern business establishment.

Among the contractors who supplied materials for the electrical installation are the following:—Lifts, The Otis Elevator Co., Ltd.; arc lamps, British Westinghouse Co., Ltd.; fittings, Veritys, Ltd., Spital & Clark, General Electric Co., Ltd.; telephone installation, National Telephone Co., Ltd.; clocks, Synchronome Co.; main switchboard, Johnson & Phillips, Ltd.; switch and fuse boards, J. H. Tucker & Co., Ltd.; ventilation work, Ashwell and Nesbit; Grinnell sprinklers, Mather & Platt, Ltd.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FRANCE—NEW CALEDONIA.—The same duties are levied as on similar goods imported into France, with some exceptions, of which the following are a few:—

Cast-iron, rough	free
Iron in bars	free
Copper, pure or alloyed, in bars, pigs, plates, hammered or beaten	free
Boilers	free

In addition to the ordinary import duties, certain octroi duties are also levied on imported goods, as follows:—

Heavy oils and other mineral oils	1 fr. per kg.
Metals	5 % ad. val.
Manufactures of metals	5 % "
India-rubber and gutta-percha goods	5 % "

FRANCE—REUNION.—The duties are the same as those in France, with certain unimportant exceptions. The following octroi duties are also levied on imported goods:—

Earthenware pipes, tiles, &c.	8 fr. per 1,000
Faience, porcelain, pottery and glassware	6 % ad val.
Mineral oils	10 fr. per 100 kg.
Machines	1 % ad val.
Marble, worked	10 % "
Metals, and manufactures thereof:—	
Of steel, tinplate, copper or tin	6 fr. per 100 kg.
Of iron, sheet, lead or zinc	3 fr. "
Of cast iron	2 fr. "
Cast-iron pipes	1 % ad val.
Products not specially mentioned	4 % "

FRANCE—ST. PIERRE ET MIQUELON.—The duties are the same as on similar goods in France, with certain unimportant exceptions.

FRANCE—SOMALILAND.—No duties are levied on electrical and similar goods imported into Somaliland.

FRANCE—TAHITI and DEPENDENCIES.—The following duties are levied:—

Metals, raw: iron, steel, copper, zinc, lead, tin, and constructional iron	12 fr. per 100 kg.
Metals worked and ready for use	13 % ad val.
Galvanised sheets	" "
Lamps for hanging	15 % "
Agricultural or industrial machinery, machine tools and accessories	Free.
Motive machinery for navigation or locomotion	"
Pumps, suction	8 % ad val.
Bitumen, solid or liquid	" "
Cement	1·50 fr. per 100 kg.
Porcelain, faience and pottery	13 % ad val.
Glassware, crystal ware of all kinds	15 % "
Goods not specially mentioned	8 % "

The following are free of duty:—Articles imported on account of the Colonial Government or the municipalities; gasoline and petroleum for heating purpose, for machinery to be used in locomotion, navigation, agriculture or industry.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,888. "Improvements in electric-driving mechanism for clockwork." L. Webber, F. C. Webber and H. V. Webber (trading as Webber & Sons). August 3rd.

17,895. "Improvements in electric flashers." C. H. Jukes-Brown. August 3rd.

17,917. "Improvements in electrical terminals." S. K. Thompson. August 3rd.

17,926. "Improved means of balancing and starting electric rail cars." M. Churchill-Shann. August 3rd.

17,932. "Improved process and apparatus for wireless operation of switches and other apparatus at a distance by sound waves and other vibrations." G. M. Karolyi, E. Klupathy and C. Berger. (Date applied for under Sec. 91 of the Act, May 12th, 1909, being date of application in Hungary.) August 3rd. (Complete.)

17,960. "Improvements in or relating to metal-filament lamps." Felten and Guilleaume-Lahmeyer-Werke Akt.-Ges. (Date applied for under Sec. 91 of the Act, January 4th, 1909, being date of application in Germany.) August 3rd. (Complete.)

17,962. "Improvements in lamps, electric and acetylene, for cycles, motor-cycles, automobiles, carriages and the like." R. W. Odery. August 4th.

17,994. "Stop for the jack springs of telephone exchanges." Siemens Bros. and Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) August 4th. (Complete.)

17,998. "Safety indicator and control for electric lifts." P. T. Kenny. August 4th.

17,999. "Metal moulding for encasing electric wires." P. T. Kenny. August 4th.

18,005. "Electric control of clocks." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) August 4th. (Complete.)

18,007. "Improvements in the manufacture of trolleys for use in electric railways, tramways and the like." A. Reiner. August 4th.

18,012. "Improvements in and relating to switches." C. Zee. August 4th. (Complete.)

18,036. "Improvements connected with circuit-breakers for electric welders and the like." S. Jevons and V. D. Green. August 5th.

18,038. "Improvements in and relating to secondary batteries." F. R. Lewis. August 5th.

18,118. "Improvements in electric furnaces for the continuous manufacture of glass." M. Sauvageon. August 5th. (Complete.)

18,221. "Improvements in and relating to electric switches and the like." M. B. Field and Ferranti, Ltd. August 6th.

18,228. "Safety electric connector plug." J. F. Conradi and E. S. Conradi. August 7th.

18,268. "Improvements in or relating to automatic electric switches, electricity meters, and similar apparatus where operating or controlling coils are in circuit whilst the apparatus is in use." F. C. Dannatt. August 7th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Winding Machines more especially applicable for Winding Coils of Wire for Electrical Purposes. E. A. Wilderspin and E. S. Hough. 15,059. July 15th.

Electric Motor-Generator Sets for supplying Arc Lamps for Searchlights and for other Apparatus. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 15,130. July 16th. (Application for Patent of Addition to No. 4,879/05.

Electrical Contacts for use in Railway Signal Systems. C. P. Finnigan. 15,494. July 21st.

Electric Furnaces for the Treatment of Ores and the like. R. E. D. Kilburn. (E. Oesterle.) 15,645. July 23rd.

Magnetic Separators. R. E. D. Kilburn. (E. Oesterle.) 15,646. July 23rd.

Electrically-heated Hand Irons. H. J. Read. 15,674. July 23rd.

Electric Relay Systems and Relays therefor. E. Raymond-Barker and A. Orling. 15,853. July 25th.

Supports for Contact Plows or Electric-Current Collectors for Electric Railways. M. E. Curwen. (J. G. Brill Co.) 16,805. August 1st.

Arc-Control Mechanisms for Projectors, Searchlights and the like. British Thomson-Houston Co. (Gen. Elec. Co.) 16,722. August 8th.

Telephone Current-Transmitting, Retransmitting and Reinforcing Apparatus. J. E. Kingsbury. (Western Electric Co.) 17,048. August 12th.

Shade-Holders for Incandescent Electric and other Lights. W. A. Gr Hill. 17,706. August 24th.

Electric Circuit Breakers. British Thomson-Houston Co. (Gen. Elec. Co.) 19,589. September 17th.

Shade Carrier for Electric, Incandescent and other Lamps. J. Nelson and Drake & Gorham, Ltd. 19,705. September 19th.

Induction Coils and Transformers. H. F. Bigge and F. R. Butt. 19,886. September 22nd. (Postdated February 10th, 1909.)

Means of converting existing Petrol Omnibus Chassis into Electric or Petrol-Electric Vehicles. W. A. Stevens. 20,210. September 25th.

Overload Circuit Breakers. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 20,268. September 26th.

Electrodes for Accumulators. H. J. Haddan. (Nya Ackumulator Aktiebolaget Jungner.) 21,004. October 5th.

Telephone Instruments. W. Aitken. 21,405. October 10th.

Mercury and other Vapour Electric Lamps. H. A. Kent, H. G. Lacell and Silica Syndicate, Ltd. 21,834. October 16th.

Dry Rezincable Galvanic Cell. F. Weatherill. 23,622. November 5th.

Magneto-Ignition Devices for use in connection with Internal-Combustion Engines. Mulholland. 24,403. November 18th.

Means for Mounting or Supporting Telephonic Instruments. T. E. Winterbottom. 25,122. November 21st.

Secondary Batteries. Van Raden & Co. and M. Metz. 25,478. November 27th.

Time Relay for Electric Currents. D. Timar and R. Ziegler. 26,967. December 12th.

1909.

Means for Mounting Electric Lamps. H. Girard. 425. January 7th. (Request under Sec. 19 not granted.)

Pendulum Electricity Meters. Fery. 687. January 11th.

Incandescent Electric Lamps. E. Bohm. 3,897. February 17th.

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges. 4,594. February 24th.

Electric Production of Iron and Steel and other Metals, and Furnaces for Carrying out the same. Aktiebolaget Elektrometall. 6,088. March 13th. (Date applied for under International Convention, August 1st, 1908.)

Working of Electric Arcs in Series. H. Pauling. 6,429. March 17th.

Overhead Conductor Frogs and Crossings for Electric Tramways. F. J. Venning. 7,795. April 1st. (Date applied for under International Convention, April 17th, 1908.)

Indicators Operated by Alternating Current. Felten & Guilleaume Lahmeyerwerke Akt.-Ges. 8,191. April 5th. (Date applied for under International Convention, July 11th, 1908.)

Time Relay for Electric Currents. D. Timar and R. Ziegler. 8,570. April 8th.

Telegraphic Receivers. A. Pictet. 10,450. May 3rd.

Safety and Anti-Inductive Appliances for Telephone, Telegraph or other Electric Conducting Wires. E. Hall. 12,869. June 1st. (Date applied for under International Convention, May 19th, 1908.)

Apparatus for Converting Alternating Potential Differences into High Continuous Potential Differences. R. Delon. 13,450. June 8th. (Date applied for under International Convention, June 19th, 1908.) (Application for Patent of Addition to No. 1,070 of 1909.)